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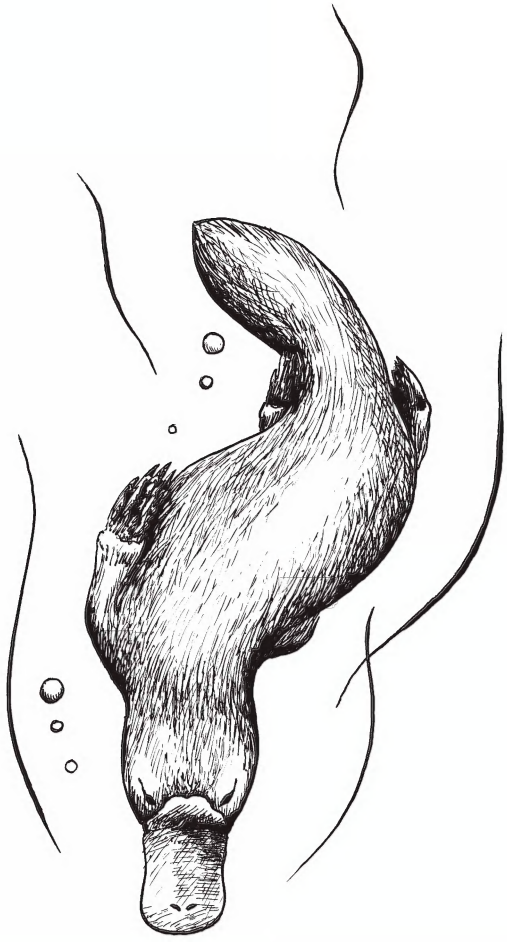

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Observations of a new patch of saltmarsh in the Trent Water

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Figure 1. Trent Water, Bridport. Google Earth image, 2015.

Trent Water

Bridport, where I live, is a small coastal town that nestles on the shores of Anderson Bay in the north-east coast of Tasmania. Once, both the Brid and the Great Forester rivers drained into the estuary named Trent Water and thence into Anderson Bay, but the Great Forester now has a different exit. Known locally as 'The Cut', it was diverted through the dunes around 1926, 4 kilometres from the original mouth. The consequence of that action is that Trent Water, now fed only by the Brid River, Brewers Creek and Coxs Rivulet, has become quite shallow and prone to unpredictable changes in sand movement, due to the lack of scouring.

Anecdotal observations cited by Steane (1996) suggest that there have been sea level fluctuations and sediment movements in the north-east since the Pleistocene Age. Steane co-ordinated a dune stabilisation program at East Sandy Point, a project which caused considerable community opposition, the effects of which are still debated. Steane observed that during the 1950s and '60s

sand had washed away from the many small beaches at Bridport. During the 1970s the sand returned to the beaches but the port suffered. I mention these movements of sand and sediment as they may be relevant to the current formation of a new patch of saltmarsh inside the estuary that is the subject of this paper. There has definitely been a build-up of sand since 2019, concurrent with the three recent La Niña years.

Saltmarsh

Saltmarsh is a unique habitat dominated by halophytes, which are plants that can tolerate salinity.

In 2013 temperate saltmarsh was listed as Vulnerable under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*. At this time, there was a distinct lack of baseline data including detailed mapping of Tasmanian saltmarshes. Enter Vishnu Prahalad, who completed this enormous task in 2014. In particular, the extent of saltmarsh in Trent Water was calculated at 12 hectares, all upstream from the township (Prahalad 2014b). My interest in saltmarsh began after attending a Field Nats outing and later a workshop led by Vishnu.

There has always been a small patch of saltmarsh measuring approximately 10 square metres growing along the banks of Trent Water, approximately 350 metres north-west of the Brid River (Figure 1). This patch contains 13 of the possible 132 plants that are **typically** found in a saltmarsh ecosystem (Prahalad 2014a). Here grow: *Atriplex prostrata*, creeping orache; one or two bushes of *Atriplex cinerea*, grey saltbush; *Austrostipa stipoides*, coast speargrass; *Carpobrotus rossii*, native pigface; *Ficina nodosa*, knobby clubsedge; *Juncus kraussii*, sea rush; *Plantago coronopus,* slender buckshorn plantain; *Poa labillardierei*, silver tussockgrass; *Puccinellia stricta,* Australian saltmarsh grass; *Spergularia tasmanica*, greater seaspurrey; *Sarcocornia quinqueflora*, beaded glasswort; *Senecio pinnatifolius*, common coast groundsel; *Tetragonia implexicoma,* bower spinach.

Plate 1. *Sarcocornia quinqueflora*, beaded glasswort

A characteristic and common component of saltmarsh, *Sarcocornia quinqueflora* is a perennial succulent herb that grows to 20 cm in height (Plate 1). By 2018 some of the *Sarcocornia* from the 10-square-metre patch of saltmarsh had begun to spread out from the bank. It was during this time that an elderly community member could often be seen hoeing the plants, mistaking them for a weed (Plate 2). He had been advised by a Natural Resource Management (NRM) officer that he should stop; some say he was also warned by police. I presented

Plate 2. The hoeing 'work' done by a community member

Plate 3. Saltmarsh beginnings, 2020

him with a copy of Vishnu's *Guide to the Plants of Tasmanian Saltmarsh Wetlands* (Prahalad 2014a) to convince him of the importance of this ecosystem.

The community member eventually gave up his 'work' and by 2020 we began to see healthy, though quite sparse, establishment of new plants spreading outwards from the bank. I have concluded after reading Saintilan (2009) that the 'weeding' may have been responsible for transplanting fragments of these perennial plants. I think it is in the community's interests to believe thus.

Plate 4. *Heloecius cordiformis*, the semaphore crab

Once *Sarcocornia* plants began to establish and spread, sand and silt became trapped at a rapid rate on the saltmarsh facing the incoming tide (Plate 3).

Crabs

As the small saltmarsh community grew, crab burrows appeared amongst the plants. Soon the crab population increased dramatically both amongst the plants and spreading out into an area of sandy mud on the south side of the plants. This area now covers approximately 1 hectare. In February 2023, I counted crab burrows in quadrats of 1 m × 1 m and the density was on average 40 burrows per square metre. The burrows amongst the *Sarcocornia* were not so easy to count, though that area covers approximately a hectare as well.

Despite this huge number of excavated burrows, crabs cannot be seen easily at low tide. As soon as any movement is sensed, the crabs make a hasty retreat into their burrows. But with patient use of binoculars, it is just possible to see eyes on stalks, and claws waving in the air. This is *Heloecius cordiformis*, the semaphore crab, easily identified by its mottled purple carapace; the juveniles have orange claws while the claws on the adults are purple (Plate 4).

I learned semaphore for my girl guide badge in 1961 but even with this knowledge, I cannot read the male crab's signals as it stands at the entrance to its burrow. It may be trying to attract the attention of females by showing off its large claws or perhaps warning other males to stay out of its territory (Australian Museum 2020).

Saintilan (2009), in his book *Australian Saltmarsh Ecology*, gave me a thorough understanding of how the components of saltmarsh fit together. In his chapter on crabs, I learned that they eat detritus, fine particles of organic matter that is deposited on the sediment by the tide every day. This way, the dead vegetation, which is prevalent in the winter here, gets recycled.

Each female crab produces thousands of eggs, which hatch into larvae. With high spring tides, large quantities of these crab larvae – called zoeae – are released on the ebb tide, providing food for small fish.

A very common crab in a tidal saltmarsh such as this is the grapsid crab *Helograpsus haswellianus*, which Richardson et al. (1997) have found co-existing with *H. cordiformis*. However, I have only found empty shells of *H. haswellianus* amongst the *Sarcocornia*.

Another crab I have observed stranded in the *Sarcocornia* at low tide is *Paragrapsus gaimardii*, the spotted shore crab. It is omnivorous and consumes both algae and small marine mammals such as worms, shellfish and other crustaceans (Richardson et al. 1997). The specimen I found had been dismembered, perhaps by a bird or rakali.

Plate 5. *Carcinus maenas*, the European green crab

Plate 6. *Mictyris longicarpus*, the soldier crab

Carcinus maenas is a non-indigenous European green crab that has adapted to a variety of substrates (Plate 5). It is invading our saltmarshes, and is a voracious predator feeding on many types of organisms, including other crabs. It also competes with native crabs for food and space. It is easily identified by the five spines either side of the eyes. *Carcinus maenas* was declared a marine pest of national significance in the Australian Priority Marine Pest List report (MPSC 2019). I have only observed dead specimens over the past two years.

Mictyris longicarpus, the soldier crab, is quite distinctive with its small, round, blue body on long jointed legs (Plate 6). As the crabs march around feeding, often in groups, they mould the sand into pellets, sorting through large quantities of sand in order to extract small quantities of algal and detrital food. The pellets are dropped and soon cover the whole

Plate 7. *Phallomedusa solida*, an air-breathing snail

Plate 8. *Salinator fragilis*, the fragile air-breather

feeding area. If disturbed, they burrow into the sand with a corkscrew motion, disappearing as quickly as they arrived. At this Trent Water site, they largely occupy the sandy area on the seaward side of the developing saltmarsh.

Other detritivores

The food chain in the saltmarsh is based almost entirely on detritus, rather than green plant material. Crabs are one group of the detritivores that are important in structuring this new saltmarsh environment through their burrows. Other detritivores contributing to the breakdown of the dead and decaying material in the saltmarsh ecosystem are snails and worms.

I found some snails living in disused crab burrows, but more often they are on the mudflats and amongst the *Sarcocornia*. They leave faecal trails as they move about feeding on slime and microalgae; the faeces contribute to building saltmarsh soils. The two most common snail species here are *Phallomedusa solida* (Plate 7) and *Salinator fragilis* (Plate 8). *P. solida* is a small (≤ 20 mm) air-breathing snail with an operculum, which is the structure snails use to close off the shell when the animal is retracted. According to Saintilan (2009), *P. solida* populations process about 45 kg of carbon per hectare per year.

Salinator fragilis is also an air-breathing snail commonly referred to as the fragile air breather. Its shell length is up to 15 mm.

Fish

Trent Water does not empty entirely at low tide and smaller fish can retreat to pools and tidal creeks. I was able to photograph some small fish which were stranded in a pool near the shore. Small fish seen from time to time are the common jollytail, smallmouth hardyhead, goby, and eastern dwarf galaxias.

Baitfish is a generic name for four or five species of small semi-transparent fish which inhabit these shallow tidal waters. In spring, large schools of *Lovettia sealii*, Tasmanian whitebait, come into the embayment and swim towards the creeks, where they spawn. Their

eggs are deposited on the bottom or amongst seagrass or other debris. They hatch in 2–3 weeks, and the fry are swept out to sea. The adults die shortly after spawning. This is an anadromous species, one that begins its life cycle in the breeding habitat of freshwater and later migrates to the non-breeding habitat in the ocean, where the juveniles grow and become mature. They are an important source of food for many larger predators.

The story of the southern black bream

Because of a lack of data, I had to rely on anecdotal evidence about the fish population in Trent Water. Fishing from a boat is not very popular owing to the shallowness of Trent Water, but there are five dedicated fishermen who have been fishing there on foot or in kayaks for probably twenty years. They provided me with this catch list: flounder, two species of flathead, mullet, yellowtail scad, the occasional silver trevally, small whiting, garfish, and the ubiquitous toadfish.

A surprising exchange of information took place with these fishermen. They had puzzled over the fact that until three years ago, none of them had ever caught bream in this water. They were indeed aware of the burgeoning growth of the 'weedy stuff' (saltmarsh), but had not realised what massive amounts of food had become available for bream because of it. Eighty percent of the diet of *Acanthopagrus butcheri*, the southern black bream, consists of crabs. They also feed on the banks of pippies (bivalves) growing close to and on the seaward side of the saltmarsh. We were excited to join the dots, though the picture is not complete yet, the bream being present only from November to April.

Birds

During the past three years I have made a list of 24 birds seen in the Trent Water. At all times of the tide, masked lapwings, pied and sooty oystercatchers, Pacific gulls, kelp gulls and silver gulls can be seen roosting on whatever patch of samphire stays above the water (Plate 9).

Plate 9. An assortment of birds roosting

Plate 10. Off-road vehicle use is one of the threats to the Trent Water saltmarsh.

Other birds in the estuary, though not necessarily near the saltmarsh, are white-faced herons, white-bellied sea eagles, great egrets, pelicans, little pied and little black cormorants, crested terns, red-capped plovers, black swans, royal spoonbills, and nankeen night herons.

As the estuary provides more food, the number of birds and different species has increased.

Risks and threats to saltmarsh

Tasmania's saltmarshes are under threat from a range of human activities – unchecked pollution, inappropriate development, off-road vehicle use (Plate 10), and rubbish-dumping, to name a few. Trent Water is no exception. It should not be taken for granted that this wetland is safe from future abuse, just because it is protected under the EPBC Act.

In late 2018 Marine and Safety Tasmania commissioned the Bridport Foreshore Master Plan (Burbury et al. 2022) to investigate the opportunities for future infrastructure upgrades and new development to support the growth in recreational fishing, tourism and commercial marine operations in Bridport. This would involve a new river entrance for the port and many changes to the natural systems. Dredging could disturb acid sulphate soils, and alter tidal regimes and water circulation patterns. These projects are deemed to be in the public interest but not necessarily in the interests of the environment.

A new outbreak of *Spartina anglica*, rice grass, is causing concern, as is the spread of *Euphorbia paralias*, sea spurge, into Trent Water.

Conclusion

All this burgeoning life is a testament to an increasingly healthy body of water. Plate 11 shows an aerial view of Trent Water and the saltmarsh. I am passionate about maintaining the natural assets of the Trent Water. As a citizen scientist, I see my task to document its natural development, and to achieve formal recognition and protection of it.

Plate 11. A drone shot of Trent Water and the saltmarsh, 2023 (photo by Jeff Jennnings)

I am in the process of mapping it and adding my observations to the Natural Values Atlas. I want to bring the community with me by talking about it, writing about it and generally fostering a love of the natural world. This is a start!

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Tasmania's endemic rainforest brown butterfly species, the leprea brown, *Nesoxenica leprea* (Waterhouse & Lyell, 1914): the end of its Gondwanan origin myth through the more recent evolutionary studies of its tribe Satyrini

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Tasmanian naturalists perhaps would be familiar with the island's brown butterfly fauna of the tribe Satyrini through encountering gatherings of browns in the genera *Geitoneura*, *Heteronympha* and *Oreixenica* along bush tracks through dry eucalypt forests and woodlands on a warm summer's day. However, a species of the local brown butterflies not frequently seen by most is the leprea brown, *Nesoxenica leprea* (Waterhouse & Lyell, 1914), which occurs in temperate rainforests of southern beech trees (*Nothofagus* spp.) as well as in subalpine swampy sites of the higher rainfall regions of the western half of Tasmania. This monotypic endemic species has two races – the cream-banded *N. l. leprea* of central and southern regions, and the orange-banded *N. l. elia* of mainly the western regions (Plate 1). It is on the wing in summer around clearings in

Plate 1. The leprea brown *Nesoxenica leprea* race *elia* (image courtesy of Simon Grove)

rainforest or on swampy margins where its larval food plant, the small sedge *Uncinia tenella* (Cyperaceae), grows.

The leprea brown differs in its colour markings, and ecological requirements, from the rest of the brown butterfly species of Tasmania and temperate Australia; there are two analogous brown species that are superficially similar in appearance and ecology – one each in New Zealand and southern South America, which are the other southern temperate land masses at the same latitudes. New Zealand's species, the forest ringlet, *Dodonidia helmsii* (Butler, 1884) (Plate 2), is also monotypic,

Plate 2. The forest ringlet *Dodonidia helmsii* (image Auckland Museum collections via Wikipedia and Creative Commons)

one of a small local fauna of browns, all of which occur in grassland and alpine ecosystems. The forest ringlet has orange banding on the dorsal surface of its wings and occurs in forests including *Nothofagus* forests on the North Island and north-western South Island, where its larval food plants, sedges in the genus *Gahnia*, occur, although the grass genus *Chionochloa* is also a food plant at higher altitudes. The second of the analogous

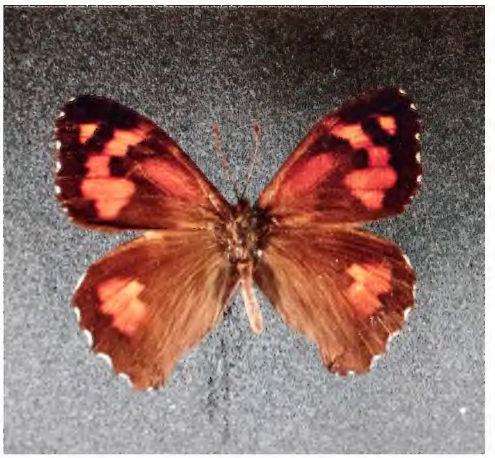

Plate 3. *Elina vanessoides* (collection of the Museum of Comparative Zoology, Harvard, via GBIF and Creative Commons)

and brown species, *Elina vanessoides* Blanchard, 1852 (Plate 3), occurs in northern and central Patagonia in Chile and Argentina on both sides of the Southern Andes. This species, which has mottled orange banding on the dorsal surface of its wings, occurs in evergreen Valdivian *Nothofagus* rainforests, with its larval food plant being the profuse temperate-climate bamboo species of the genus *Chusquea*, which is in the grass family (Poaceae).

I first became aware of the leprea brown through conversations with renowned Tasmanian butterfly expert, the late Len Couchman, at the end of the 1960s when he introduced me to his comprehensive collections of Tasmanian butterflies, and discussed with me his major taxonomic and ecological contributions to the knowledge of the Tasmanian butterfly fauna. At the time, the theory of continental drift and the breakup of the former supercontinent Gondwana had started to come to the attention

of the more interested general public. During the course of our conversations, Couchman said that an American specialist who had corresponded with him had claimed that there was a similar butterfly species to the leprea brown in (temperate?) South America. In the years following these conversations with Len Couchman regarding Tasmania's butterfly fauna in general, I encountered both subspecies of the leprea brown during my youthful bushwalks into Tasmania's western wilderness areas, although at that time I had forgotten the issue of a South American link with Tasmania's leprea brown. However, later bushwalking trips in Patagonia and New Zealand, and my growing general interest in southern hemisphere faunal biogeography, brought back to me Couchman's comment regarding the leprea brown's potential southern link with South America, which led me to further investigate this species.

As a result of my private research, I became aware that the early-20th-century amateur entomologist A. J. Turner had recorded the leprea brown's association with *Nothofagus* trees at Cradle Mountain. Turner's observations were cited by Couchman and Couchman (1977, p. 90): "fifty years ago A. J. Turner (1925) noted the butterfly's habit of settling on the lichen-covered twigs of the tree in cold weather, and also noted that 'this association and protective resemblance must be of very ancient origin'". They also cited Turner's comment that "[t]his butterfly is surely a relict species of the Antarctic connection". The 'Antarctic connection' of some aspects of the flora and fauna of the southern hemisphere was noted as early as the mid-19th century by the botanist A. J. Hooker and the biologist Charles Darwin, although the roots of common origin had been uncertain until the theory of continental drift came to the fore.

Eminent Australian butterfly authority Michael F. Braby, as recently as the start of the 21st century, inferred a Gondwanan origin for the brown butterfly fauna of (at least southern) Australia (Braby 2000), which includes the leprea brown. These temperate Australian browns were fairly recently classed as belonging to the subtribe Hypocystina, which was formulated by Miller (1968) and regarded as being shared between Australasia and South America. The more recent comprehensive phylogenetic studies of the Satyrini by Peña et al. (2009) discarded Hypocystina as a redundant grouping, and various molecular cladogram models have shown that the temperate Australasian brown genera (including those of New Zealand) belong to the Australasian, Oriental and Holarctic distributed subtribe Coenonymphina, as first conceived by English lepidopterist J. W. Tutt in 1896. The various molecular cladograms by Peña et al. closely link *Nesoxenica* to the southern and eastern Australian genera *Argynnina* and *Tisiphone* as well as to the analogous genus *Dodonidia* (forest ringlet) of New Zealand.

Countering the older notion of a common Gondwanan-derived subtribe Hypocystina is the now more widely accepted view that the South American browns largely belong to

the subtribe Pronophilina, a subtribe first proposed by Finnish authority E. Reuter in 1896 and supported by Peña et al.'s phylogenetic analysis in 2009. The Patagonian analogue of the leprea brown, *Elina vanessoides*, is within the subtribe Pronophilini and is part of a regional brown group of at least 26 species and 11 genera which has been recently defined by the landmark monograph of the southern temperate Pronophilina of southern South America by Matz and Brower (2016). This has finally brought clarity and resolution to the former nomenclatural and taxonomic chaos in this group of browns of this region.

Peña et al. (2009) stated that their analysis did not produce a conclusive whole scenario of the origin and radiation of the subtribes of the tribe Satyrini; however, they did point out that the tribe Satyrini appears to have originated in the Old World during the Eocene epoch about 42 Mya, and rapidly diversified into most of its subtribes during the Oligocene epoch between about 32 and 24 Mya as a result of the decline of global forest cover and the butterflies' adaptation to the spread of grasslands. They state that the subtribe Coenonymphina evolved in South East Asian – Indo-Australian regions, while the subtribe Pronophilina is thought to have evolved in the Palaearctic and dispersed to the New World via North America (where its diversity is now diminished due to past extinctions), and with the subtribe subsequently greatly diversifying in the Neotropical Realm. These scenarios therefore rule out any Gondwanan origin and connection for the brown butterfly subtribes of temperate Australasia and South America, and point to the Old World tropics being the ultimate source of origin long after the break-up of Gondwana. Despite the Satyrini being aligned with grasslands or grassy habitats, Peña et al. state that there has been some return of taxa to the rainforest habitats, such as would be the case with the leprea brown and its analogous species in the temperate rainforests of the southern hemisphere in New Zealand and Patagonia.

The origin of *Nesoxenica* is plausibly the result of *in situ* evolution alongside other related genera of the subtribe Coenonymphina in temperate Australia during the late Neogene period. The genus *Dodonidia* in New Zealand derived from the local radiation of ancestral stock from Australia by dispersal across the Tasman Sea, as evident from the fairly close relationship with the Australian genera. This model of origin of the browns in New Zealand is supported by current observations that various Australian butterfly species arrive in New Zealand as casual wind-blown strays. *In situ* evolution of the analogous Patagonian taxon *Elina* sits within the phylogeny of the southern temperate South American genera, suggesting local evolution of the genus in that region. The similarity in colouration and habitat alignment of these three analogous species, despite the early divergence in their ancestry, is likely to be the result of convergent evolution of the three species: bright, longitudinal dorsal markings against a

dark basal colour on the dorsal surface are likely to be recognition signals for mating potential in these generally gloomy habitats, whereas the darker basal colour would enhance thermal absorption when sunlight is available.

In conclusion, the putative Gondwanan connection of *Nesoxenica* and *Elia* is now no longer thought to be likely and is an example of historical narratives in biogeography being overturned by the application of the modern science of molecular/geographical cladistical modelling. Determining the conservation status of the three species is collectively incomplete, although *Dodonidia helmsii* is regarded as 'at risk' by New Zealand conservation authorities; while the Valdivian rainforests of *Elina vanessoides* in Chile are still being exploited, any impact on the species apparently has not been documented. The leprea brown is as yet not classified as under threat as large areas of its habitat lie in the national parks and reserves of western Tasmania. My most recent observation of this species is from the northern end of Lake St Clair on 31 December 2020 (the western *elia* race here), where several adults were visiting the flowers of *Melaleuca squamea* bushes on the edge of riparian tea-tree vegetation in bright sunshine.

Acknowledgements

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The curious case of the mystery snail – a freshwater incursion of an unwanted intruder in Tasmania

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Introduced species are nothing new to the Australian landscape, their presence seldom resulting in positive outcomes for our native biodiversity. Many species have been intentionally imported as domestic pets, crops, curios, to gentrify the landscape (through acclimatisation societies), or even as biological control elements, and in hindsight it is difficult to comprehend why more scrutiny of potential impacts was not performed prior to their importation. These concerns are intensified as we enter a period of rapid environmental modification strongly influenced by climate change.

While current climatic conditions prevent many exotic species from acclimatising, so that they are destined for permanent captivity or horticultural management, other species demonstrate more capacity for adaptation to the local conditions, allowing them to significantly alter the landscape. Two prime local examples of such botanical interlopers are gorse (*Ulex* sp.) and broom (*Genista* sp.). Owing to their fecundity, dispersal capacity and unpalatability, these species have escaped from hedgerows and other plantings into Tasmania's native forests, often dominating the understorey of forest communities, shading out or otherwise outcompeting the native flora, and reducing habitat availability to some native fauna. Likewise, blackberry (*Rubus* sp.), a species readily dispersed by both native and introduced birds, today overwhelms riparian communities and understorey vegetation in wet forests and intrudes into agricultural settings and roadsides throughout Tasmania.

However, it is not only introduced plants which are of concern. Exotic animal species include the domesticated cat (*Felis catus* Linnaeus, 1758), which has become a top predator in Tasmania and is now habituated to every conceivable habitat, save waterways and wetlands, predating both native and introduced mammals, birds and reptiles. While to many the introduced lyrebird (*Menura novaehollandiae* Lesson, 1828) is not considered destructive, or even as having a negative impact, the species is now well established in wet forest communities across the state. It is a voracious consumer of litter-dependent invertebrates, and its true impact is poorly understood.

When asked to name an introduced animal, people often tend to focus on the larger, more conspicuous species

such as goats, pigs, horses or camels, rather than smaller, often cryptic species.

But there are also examples of inconspicuous aquatic invaders in Tasmania. One such small, unassuming species is the freshwater mollusc *Potamopyrgus antipodarum* (J. E. Gray, 1843), commonly known as the New Zealand mud snail, that was unintentionally introduced to Tasmania in the mid- to late 1800s (Ponder 1988). Its clonal method of reproduction and fecundity are traits giving this species a superior ability to colonise waterbodies in the agricultural and peri-urbanised landscape across Tasmania, where it is now the dominant freshwater mollusc, outcompeting, and often dispossessing, the native molluscs. Such is its capacity to colonise, the NZ mud snail has now spread to many countries worldwide, including Norway, Japan and the USA to name but a few. In some of these countries, it is recognised as an invasive species, and targeted management actions are directed at preventing its further spread. In Tasmania, however, no thought is given to the species or its impact on native freshwater molluscs by management agencies.

Thankfully, biosecurity is taken more seriously in contemporary Tasmania. While legislation exists to prevent importation of species of concern recognised under the *Nature Conservation Act 2002* and *Biosecurity Act 2019*, the system is not foolproof and some more 'benign' species slip through, intentionally or otherwise. One example is the ramshorn snail, *Marisa cornuarietis* (Linnaeus, 1758), identified from a single urban pond in Hobart. Fortuitously, the species did not establish, and the Tasmanian Museum and Art Gallery now holds the only specimen known from Tasmania. It is in this space that I now relate one of our latest, highly improbable, introductions: that of the large and impressive, yellow aquatic gastropod *Pomacea diffusa* Blume, 1957, otherwise known as the mystery snail (Plate 1).

Plate 1. *Pomacea diffusa* Blume, 1957, otherwise known as the mystery snail (image A. Hallan)

Plate 2. Kimberley Warm Springs reserve

Pomacea spp. (mystery snails) belong to the freshwater mollusc family Ampullariidae, commonly referred to as apple snails. *Pomacea* spp. are native to Southern and Central America, the West Indies, and the Southern United States. *Pomacea diffusa* originates in the Amazon River (its type locality is in Bolivia), and in its natural environment it inhabits sediment, aquatic vegetation and other available aquatic substrates in the comparatively warm, tropical water. Its lifespan in captivity is 1–3 years, but in the wild it is usually 1 year. The species is gonochoric, meaning individual snails are either male or female, and reaches an impressive 65 mm shell height, much larger than any of our native freshwater snails. Females produce pink-coloured egg masses, which they deposit on emergent vegetation (Ponder et al. 2023).

Since it was considered unlikely to become established as a pest species in Australia, *P. diffusa* was approved for introduction and is available for public purchase through the aquarium trade in eastern states. Its large size and striking colour makes it an attractive companion species in home aquariums. Since it was thought even more unlikely to become established in our comparatively cold rivers and streams, it was also approved for importation and sale through pet store outlets in Tasmania. Unfortunately, in recent times the species has been located in a number of waterways in Townsville and Brisbane, where it has adapted and is now well established (Ponder et al. 2023). Likewise, its availability in Tasmania has been the conduit for an inconceivable and unfortunate event.

It was somewhat concerning when, in early 2022, I was contacted by a

ranger from the North West Region Tasmania Parks and Wildlife Service (PWS), requesting the identification of a large yellow "mystery snail" found in the Kimberley Warm Springs, northern Tasmania (Plate 2), a reserve managed by the department. To say that I was somewhat alarmed is an understatement. Up to that point I had only ever heard about the highly invasive pest species *Pomacea canaliculata* (Lamarck, 1822), a species so far not detected in Australia. Almost immediately Biosecurity Tasmania became involved and between us confirmation of the snails' identity was provided within days: not the more invasive species (breathe easy), nonetheless a related intruder, *P. diffusa*. Its discovery raised questions: How many were present, how did they come to be there, and how long has it been in the waterbody? Whatever the answers, the immediate concerns were about the species' capacity to persist inside the warm water of the Springs and, if so, whether it was able to reproduce and spread downstream into the Mersey River, though that seemed less likely given the lower water temperature. Fears about potential parasites or diseases transferring to a native freshwater snail, *Austropyrgus solitarius* Clark, Miller & Ponder, 2003 (Plate 3), endemic to the Kimberley Warm Springs, were also front of mind. These concerns resulted in a request that PWS undertake to remove the offending individuals. At the time it was considered likely that the introduction had been recent and that only low numbers of the snail would be present. Being a small and relatively shallow wetland (<1.5 m at the deepest point) with crystal clear water when unimpeded by submerged *Potamogeton* and *Chara* beds, algae, and emergent *Typha* and watercress, it seemed likely that an eradication program would be successful.

Fortuitously, the eradication request coincided with an aquatic vegetation

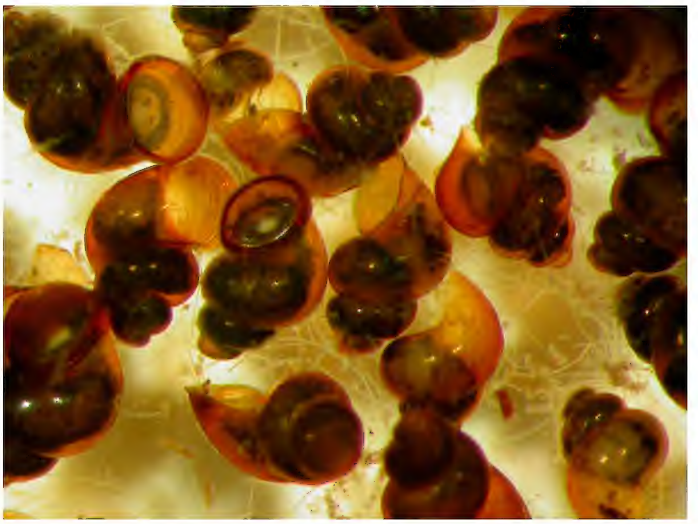

Plate 3. The endemic *Austropyrgus solitarius*; shell length (or height) = ~1.80 mm

management program periodically undertaken by PWS, who manage the reserve to control vegetation in the wetland, to keep the site accessible to locals and tourists as a swimming hole. It was during a preliminary assessment for the weed removal that the snail was first detected.

Donning waders, PWS staff commenced removal of the offending snails in late autumn 2022, at first removing three, the figure rising to four or five specimens, then 10. By this time, it was winter and ambient air temperatures plummeted to single digits while the spring water remained a comfortable 22 degrees Celsius. The temperature discrepancy was still challenging, even when wearing waders, to access the site and remove any visible yellow molluscs. Initially, following the removal of the 10 specimens, it was thought these were likely to be all the specimens in the wetland. However, the water depth prevented collection of several specimens that were visible on the substrate but, frustratingly, out of reach. Then, with the collection of several size cohorts it became apparent that the species had taken a foothold (pardon the pun) and had apparently reproduced in the wetland (unless several cohorts had been released). Despite the lack of evidence of egg masses, further attempts to eradicate the snails resulted in more than 200 individuals, some juvenile, being removed and dispatched. At this point a decision was made to delay further removal attempts until summer, while plans to manage the aquatic vegetation continued.

During the hiatus, I visited the Springs in October and again in November 2022 to assess the situation for myself, and to opportunistically survey for the native endemic snail, which had last been recorded in significant numbers in 2010. In conjunction with surveying for the native snail, long minutes were spent circumnavigating the wetland, peering into the depths to detect any sign of the yellow snail. On my second visit, however, I saw a single active mystery snail on the substrate in the deepest part of the wetland, close to where warm water vents from its subterranean source. Moving around the wetland and then returning to the observation site only minutes later, there was no longer any sign of the mollusc. The sparse aquatic vegetation adjacent to where the snail had been observed clearly was insufficient to provide camouflage; thus, the only likely explanation for the snail's disappearance was a burrowing capability – the silty substrate likely to be concealing its bulky shell.

Despite my observation in November, a thorough search by the PWS staff in early December 2022 failed to detect any further *Pomacea*, and thus the eradication program was wound up. I have subsequently returned twice to the Springs, once in April 2023 and again in August 2023. At both times I saw no further sign of the intruder while, on a positive note, confirming the continued presence of the native *Austropyrgus* species, although in significantly lower numbers than previously recorded.

So, should we now consider this a successful eradication of the interloper,

since it has not been positively observed since November 2022? The small size of the wetland, and quick action by PWS staff, have contributed to the probable successful removal of the species. Further, the short lifespan of individual snails (1–3 years in captivity, 1 year in the wild) offers hope that, if only the one snail observed in November remained, and that snail was either male or non-fertilised and thus did not produce eggs, it has subsequently died. However, vigilance remains necessary; a watchful presence is required to detect any glimpse of yellow in the depths, particularly if the burrowing ability of the snail is providing camouflage.

To end on a positive note, in August 2023 I attempted to source a mystery snail from a local pet store to obtain a photograph for this article. Apparently, the mystery snail has since been added to the list of prohibited species in Tasmania and is now no longer available to be sold commercially.

Acknowledgements

Many thanks go to Ben Hill, Ranger in Charge, and staff of the North West Region Parks and Wildlife Service, who discovered and proactively managed the incursion of *Pomacea diffusa*. Likewise, to Biosecurity Tasmania for their input and prohibiting future sale of the species.

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An investigation of species of *Phoracantha* longhorn beetles (Coleoptera: Cerambycidae: Cerambycinae) occurring in Tasmania and observations on the life history and habits of *Phoracantha mastersi* and *Phoracantha lata*

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Introduction

The genus *Phoracantha* comprises 40 described species distributed throughout Australia and New Guinea (Wang 1995; Slipinski & Escalona 2016). They are relatively large, nocturnal longhorn beetles usually associated with *Eucalyptus* species as larval hosts. In previous works (Semmens et al. 1992; Grove et al. 2021) up to nine species of *Phoracantha* have been listed as occurring in Tasmania. However, four of these species appear to be the result of misidentifications.

Doubtful Tasmanian species

Grove et al. (2021) list *P. synonyma* and *P. tricuspis* as occurring in Tasmania; however, these records appear to have been based on misidentifications. The *P. tricuspis* record was based on a record from the Atlas of Living Australia (ALA) that has since been removed (ALA 2023a) and the *P. synonyma* records were based on incorrectly assigned *P. lata* (S. Grove pers. comm.). No Tasmanian specimens of *P. tricuspis* or *P. synonyma* are registered in public collections (ALA 2023a, b) and none are to be found in the collections of either the Tasmanian

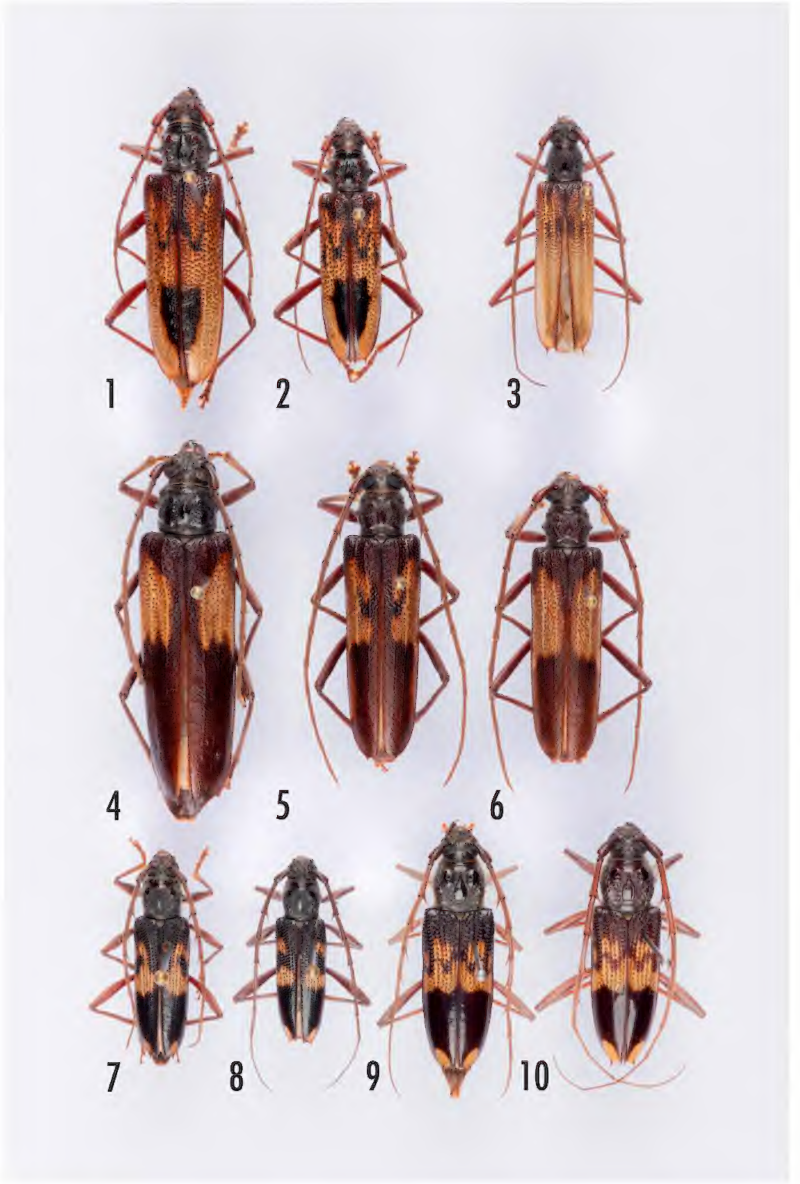

Plate 1. Tasmanian *Phoracantha*. Natural size. 1&2 *P. lata*, 3 *P. superans*, 4–6 *P. mastersi*, 7&8 *P. punctata*, 9&10 *P. semipunctata*. Note antennae of males extending beyond elytra. Photo: Angela Casey.

Museum and Art Gallery (TMAG) or the Queen Victoria Museum and Art Gallery (QVMAG). Both species are widespread in coastal and near coastal habitats in eastern mainland Australia (ALA 2023a, b; Wang1995; Slipinski & Escalona 2016).

Tasmanian records of *P. acanthocerus* (as *Tryphocaria acanthocera*), *P. longipennis* (as *Tryphocaria longipennis*) and *P. obscura* in Semmens et al. (1992) are not supported by any known Tasmanian specimens in public institutions and should be considered as highly dubious (Grove et al. 2021).

Phoracantha species known to occur in Tasmania

There are five species of *Phoracantha* that we can confirm as occurring in Tasmania since they are supported by reliably identified specimens in Tasmanian and mainland institutions. They are *P. lata*, *P. mastersi*, *P. punctata*, *P. semipunctata* and *P. superans*. All five species are among the state's largest beetles, ranging from 20 to 42 mm in head–body length (Plate 1). Most are common and widespread in the drier and warmer eastern half of the state, coastal habitats and on larger Bass Strait islands (ALA 2023a). Large local populations have been found associated with infested host trees (*Eucalyptus* and *Acacia*) nocturnally and they are also attracted to light traps.

The life history and habits of most *Phoracantha* species are poorly understood (Wang 1995; Slipinski & Escalona 2016). The exception is *P. semipunctata* (Plate 1 specimens 9&10), which has spread around the world wherever eucalypts are grown and has become a serious economic pest outside its native Australian range, particularly in South Africa and North America (see extensive published data summarised in ALA 2023c).

Two clearly defined functional groups of *Phoracantha* spp. were identified by Wang (1995). The first group comprises consumers of dead or dying trees, strongly attracted to recently fallen or felled timber of all sizes. *Phoracantha punctata* and *P. semipunctata* are in this group. These species typically have 1–2 generations per year and are highly fecund producing egg masses of up to 300+ eggs deposited under loose bark. Larvae feed in the wood layer directly beneath the bark before tunnelling into the cambium or heartwood to pupate. These dead or dying tree consumers have very flexible trophic habits within their respective host tree genera. *Phoracantha semipunctata* has more than 35 documented *Eucalyptus* hosts (Duffy 1963; Wang 1995).

The second group feeds on living trees, typically *Eucalyptus* spp. and favours younger trees in the age range of 6–20 years. *Phoracantha superans*, *P. lata* and *P. mastersi* are in this group. Species in this group tend to be more host-specific, have relatively long life cycles (2–3 years) and feed on the cambium layer between the bark and heartwood before boring galleries into the heartwood to pupate. Larval galleries can be extensive and extremely damaging to host trees, killing large portions of the stem thus making the trees susceptible to snapping in high winds.

The sexes in all *Phoracantha* spp. are easily differentiated by the length of the antennae. In males the antennae extend beyond the elytra when the beetles are at rest (Plate 1). Sexual size dimorphism (larger females) is demonstrated in all Tasmanian species (Plate 1).

In this paper, we confirm the identity of Tasmanian species, provide notes on distribution and habits, and provide the first information on aspects of the life history and habits of *P. lata* and *P. mastersi* in Tasmania.

Phoracantha semipunctata (Fabricius, 1775) (Plate1 specimen 9: Female.
Brisbane, Queensland.
Reg. No.QVM:2017:12:0352.
Plate 1 specimen 10: Male.
Brisbane, Queensland.
Reg. No. QVM:2017:12:0353)

The status of this species in Tasmania is uncertain. Only a single Tasmanian specimen is known to exist, collected by the senior author at Greens Beach, central north coast of Tasmania, in February 1984. This specimen is now in the collections of the Australian National Insect Collection (ANIC) in Canberra (Catalogue number 25-025621). The only other record is a photograph of a specimen found dead on the beach at Temma in the north-west of the state in 2020 (ALA Catalogue number: Observations: 64847660). A single record from TMAG listed in Grove et al. (2021) later turned out to be from Darwin, NT, after a data label check (S. Grove pers. comm.).

Given the scarcity of records, and the fact that both known specimens were found on the northern or western coast, it is possible that *P. semipunctata* is not established in Tasmania but rather is occasionally brought in on northerly fronts from the mainland, as many mainland insect species regularly are (Hill 2011, 2013).

Phoracantha semipunctata is common and widespread throughout mainland Australia (ALA 2023a; Slipinski & Escalona 2016) and utilises a wide range of *Eucalyptus* spp. (Myrtaceae) as host plants (extensive published data summarised in ALA 2023c). In addition, Duffy (1963) records *Syncarpia glomulifera* (Sm.) Nied (as *Syncarpia laurifolia* Ten) and *Angophora floribunda* (Sm.) Sweet (as *Angophora intermedia* DC), also both in the family Myrtaceae.

Phoracantha punctata (Donovan, 1805) (Plate 1 specimen 7: Female.
Launceston, Tasmania.
Reg. No. QVM: 2022:12:1049.
Plate 1 specimen 8: Male.
Launceston, Tasmania.
Reg. No. QVM:2022:12:1044)

This species is common and widespread throughout eastern and coastal Tasmania in woodland habitats. Adults commonly come to mercury vapour lamps and black lights operated during the warmer months. The first author has collected adults sheltering diurnally under splitting bark on insect-damaged black wattle *Acacia mearnsii* De Wild and under exfoliating bark on white gum *Eucalyptus viminalis* Labill. Larval hosts in Tasmania are larger trees in the *Acacia* genus. Bashford (1990) lists *Acacia mearnsii* as a Tasmanian host plant and five ex-Forestry Commission specimens

reared from *A. mearnsii* are present in the TMAG collections (S. Grove pers. comm.) as well as a specimen recovered from within the trunk of a silver wattle *Acacia dealbata* Link.

Mainland host trees include silver wattle *Acacia dealbata* Link (Webb 1990; Dixon 1908 [as *A. mollissima*]), *A. decurrens* Willd (Gallard 1916; Van Den Berg 1982; Webb 1987; Webb et al. 1988), *A. homalophylla* A. Cunn. ex Benth. (Duffy 1953), *A. implexa* Benth., *A. baileyana* F. Muell. (Webb 1987), *A. fimbriata* A. Cunn. ex G. Don, *A. irrorata* Sieber ex Spreng. and *A. leiocalyx* Sieber ex Spreng. (Hockey & De Baar 1988).

We suggest that records of *P. punctata* utilising eucalypts as larval hosts (e.g. Tepper 1887) should be treated with caution. Many of these records are old, may be based on misidentifications or incorrectly assume that adult beetles sheltering diurnally under bark on eucalypts is an indication that those trees act as larval hosts. R. de Keyzer (pers. comm.) supports these observations and has reared this species many times from *A. decurrens* in NSW but has never recorded it associated with *Eucalyptus*.

Phoracantha punctata is widespread on mainland Australia (ALA 2023d) and has been accidentally introduced to New Caledonia and New Zealand (Slipinski & Escalona 2016).

Phoracantha superans Pascoe, 1862
(Plate 1 specimen 3: Male.
King Island, Tasmania.
Reg. No. QVM: 2019:12:1697)

In the authors' experience this is the most infrequently encountered *Phoracantha* species in Tasmania. This species comes at night to light traps, but given the low capture rates, it is probably at relatively low densities at most locations. All specimens seen by the first author were taken at light in eucalypt-dominated dry woodland and scrub on King Island in western Bass Strait, at Beechford on the north-east coast, Launceston, and Sandy Bay, Hobart, in the south. These records reflect ALA records (2023a) that demonstrate an eastern and north coastal distribution extending into the larger islands of western Bass Strait.

Interestingly, mainland records are also scarce with a single Victorian specimen and two records from southern coastal Western Australia appearing on the ALA (2023e).

A Tasmanian specimen in the Australian Museum (Wang 1995) has label data stating "bred from she-oak". This record must relate to *Allocasuarina* sp. as this is the only genus of she-oak occurring in Tasmania (M. Baker pers. comm.).

Wang (1995) records *Allocasuarina fraseriana* Miq. (as *Casuarina fraseriana*) as a larval host. This species is confined to southern coastal Western Australia (ALA 2023h), but Wang (1995) does not record examining any Western Australian *P. superans* specimens so the origins of this record remain unclear.

Phoracantha lata (Hope, 1841)
(Plate 1 specimen 1: Female.
Longford, Tasmania.
Reg. No. QVM: 2022:12:1113.
Plate 1 specimen 2: Male.
Longford, Tasmania.
Reg. No. QVM: 2022:12:1117)

There has been confusion around the name of this species for many years with some authorities referring to the species name as '*latus*' (e.g. ALA 2023f). *Phoracantha* is feminine and so *lata* is the correct ending (A. Slipinski pers.comm.).

This species is common and widespread in eastern and north coastal Tasmania in woodland habitats and is distributed widely in south-eastern mainland Australia (ALA 2023f).

Previous authors have suggested that no biological information is available for this species (Wang 1995; Slipinski & Escalona 2016). However, in northern Tasmania the senior author has documented high population densities developing locally in areas where host trees (*Eucalyptus* spp.) become stressed (particularly during droughts) such as shelter belts grown in rural habitats and monocultures of eucalypts planted in urban areas. In such situations, large numbers of beetles can be attracted to lights nocturnally and they have also been observed mating and ovipositing on host trees.

In the first author's experience, only smooth-barked eucalypts are utilised as larval hosts. *Eucalyptus globulus* Labill., *E. ovata* Labill, *E. nitens* (H. Deane & Maiden) Maiden and ornamental *E. cernua* Brooker & Hopper have all been utilised as hosts in the Launceston area. A specimen in the TMAG collection was reared from *Eucalyptus nitens* (S. Grove pers. comm.).

Larval galleries observed by the lead author involved a single larva in stem diameters ranging from 60 to 200 mm. The larva feeds on the cambium layer between the heartwood and bark, creating an oval chamber up to 80 mm in diameter before boring inwards to create a pupal chamber in the heartwood. The future emergence hole is sealed with a frass plug (Plate 2) before the larva pupates head downwards at the termination of the larval gallery, which can be 100 mm in length. At this stage, there is no obvious indication of the site of the larval gallery as it is still covered in intact bark. The bark over the feeding chamber and emergence hole dries and splits in the sun and may eventually fall away leaving the emergence hole clear (Plate 2). Pupation takes place in late summer or spring with eclosion occurring in the summer of the following year. The larval bore can weaken host trees making them susceptible to snapping off in high winds. A *Eucalyptus cernua* sapling with a trunk diameter of 60 mm in the first author's garden snapped off at ground level in September revealing a teneral *P. lata* in its pupal chamber.

Signs of larval infestation in host trees are subtle. Small amounts of frass can be ejected, sap commonly leaks from the damaged cambium in the feeding gallery and a distinct swelling may appear on the stem in the later larval stages as the tree attempts to heal the damaged cambium layer under the bark.

From field observations in the Launceston region, the first author suggests the life cycle from egg to emerging adult appears to be at least three years.

Plate 2. Larval feeding gallery and frass-plugged oval emergence hole (at top of chamber) of *Phoracantha lata* in a *Eucalyptus globulus* stem. Photo: S. Fearn.

Plate 3. Limb of mature *Eucalyptus nitens* killed by larval infestation of *P. mastersi*. The entire cambium layer has been consumed. Photo: S. Fearn.

Phoracantha mastersi (Pascoe, 1875).
(Plate 1 specimen 4: Female.
Longford, Tasmania.
Reg. No. QVM: 2022:12:1029.
Plate 1 specimen 5: Male.
Longford, Tasmania.
Reg. No. QVM: 2022:12:1129.
Plate 1 specimen 6: Male.
Longford, Tasmania.
Reg. No. QVM: 2022:12:1140).

This species is common and widespread in eastern and north coastal Tasmania in woodland habitats and is distributed widely in south-eastern mainland Australia (ALA 2023g).

The biology of this species is better known than most of the eucalypt-feeding *Phoracantha*. Larval hosts are living specimens of a wide range of predominately smooth-barked eucalypts. In Tasmania, the first author has recorded linear monoculture plantings of *Eucalyptus nitens* and *E. ovata* in rural shelter belts and local authority urban plantings becoming heavily infested with *P. mastersi* larvae with many trees dying, breaking off in wind or permanently scarred by larval feeding (Plate 3).

Phoracantha mastersi can form high population densities in *Eucalyptus* monocultures of similar age/size and can be a significant forestry pest in Tasmania (Wang 1995).

Plate 4. Larval galleries of *P. mastersi* in the main stem of *E. ovata*. These larval tunnels are for eventual pupation in the heartwood. Note destruction of cambium layer on left side where larvae fed for several years. Photo: S. Fearn.

Plate 5. The three largest sizes of *P. mastersi* larvae found infesting eucalypts at Scotch Oakburn Park, Launceston. Photo: J. Douglas.

The former Forestry Tasmania entomology collection was deposited at TMAG and it contains insectary-reared *P. mastersi* from *E. nitens*, *E. globulus*, *E. viminalis* Labill., *E. obliqua* L'Hér. and *E. cordata* Labill.

In addition, we have observed larval infestation in *E. amygdalina* Labill. and *E. barberi* L. A. S. Johnson & Blaxell.

On mainland Australia, host plants include *E. globulus* (French 1909; Duffy 1963; Wang 1995), *E. amygdalina* (French 1909; Duffy 1963), *E. nitens* (Wang 1995) and *Corymbia maculata* (Hook.) (as *Eucalyptus maculata*) (Brimblecomb 1956; Duffy 1963; Wang 1995).

We suggest that a record of "*Acacia* sp." from Brimblecomb (1956) be treated with caution.

In May 2022 the second author cut up and split for firewood dead and dying eucalypts in a 7-hectare flood plain rehabilitation site at Scotch Oakburn Park on the North Esk River, Launceston (GDA94) 514219E 5411653N. The trees were a subset of nearly 500 eucalypts planted over a 20-year period to revegetate riparian habitats. All the affected trees had suffered considerable insect borer damage. While these trees were being cut into lengths, extensive larval galleries were discovered (Plate 4) as well as large numbers of cerambycid larvae of different sizes (Plate 5). Heavily infested trees were easily identifiable due to the great quantities of frass up to 20 cm deep that built up at the base of trees. Larvae feeding in the cambium layer and inner bark had opened up small holes 2–3 mm in diameter to the outside through which frass was expelled (Plate 6). When the bark was removed with an axe, extensive larval galleries packed with frass were exposed in the cambium layer (Plate 7). Further cutting into the heartwood exposed the main larval galleries where pupation would eventually take place (Plate 8). The largest larvae were exposed in the terminal end of their galleries in the heartwood (Plate 9). Plates 6 to 9 depict the same tree as layers of bark and wood were cut off to display the various layers of the larval galleries.

A number of fully hardened adult *P. mastersi* were discovered dead in pupal chambers, apparently killed by a fungal attack.

Four distinct sizes of larvae were found in the infested trees. The smallest were only 7 mm long and were thought to be recent hatchlings from eggs laid in the summer of 2021–22. The next two sizes appeared to be one moult apart and probably resulted from eggs laid at different times through the same spring–summer season. Adult emergence in Tasmania is asynchronous from October to February with a peak in December, so eggs can be laid months apart in the same season. The largest larvae were 50 mm long and 11 mm across the pronotum (Plate 5) and had fully constructed galleries into the heartwood. These larvae would probably pupate through autumn or spring, emerging as adults the following summer. From our observations, the evidence strongly suggests a minimum of three years from egg to emerging adult. A similar life cycle is suggested by Wang (1995).

Plate 6. Numerous small larval frass ejection holes in trunk of *E. ovata*. Photo: S. Fearn.

Plate 7. Larval feeding galleries of *P. mastersi* in cambium layer of trunk of *E. ovata*. Larvae avoid one another by maintaining a thin partition of wood and frass between feeding galleries. Photo: S. Fearn.

Tasmanian *P. mastersi* appears to display very similar larval habits to *P. semipunctata* (Hanks et al. 1993, 2005). Development time of *P. semipunctata* is strongly influenced by ambient temperature with larvae becoming dormant in cool weather (Hanks et al. 2005). We suggest a similar phenomenon occurs in all Tasmanian species of *Phoracantha*. Tasmania's cool and variable climate with a distinct winter season possibly adds considerable time to the larval cycle because larvae become quiescent over winter.

Twenty-five *P. mastersi* larvae of all sizes were collected, preserved in ethanol and lodged in the entomology collection of QVMAG in three batches (QVM:2022:12:2081-3).

Mature larvae pupate head downwards at the terminal end of the heartwood gallery after creating an oval pupal cell sealed at each end with chewed-off wood fibres. Before the pupa undergoes further development in the pupal chamber, the oval hole leading to the cambium feeding chamber (Plate 8) is plugged with wood fibres. Adult beetles exit the pupation tunnel by chewing through this plug.

The sex ratio of emerging adults is unknown but females are seen much less frequently at night on host trees, or coming to light traps, than males.

A total of 473 eucalypts comprising seven species were present on the

Plate 8. Entrances to main larval galleries into heartwood of *E. ovata*. The bore extends upwards into the heartwood for 100 mm. At high densities, larvae are tightly arranged with only a thin layer of wood between bores. Plate 4 provides a cross-section of larval gallery arrangement. Photo: S. Fearn.

Plate 9. Maximal sized *P. mastersi* larva at the termination of its larval tunnel in the heartwood of *E. ovata*. Photo: S. Fearn.

7-hectare Scotch Oakburn site ranging in age from 4 to 20 years. Of these, four species showed obvious signs of *P. mastersi* larval infestation (Figure 1). Analysis of any preference for host tree age was only possible for *E. ovata* as it was the only host species that had infested and non-infested trees across multiple age categories. Analysis demonstrated that trees that were 9–15 years old were more likely to be attacked (Figure 2) (χ^2 (3, 308) = 23.54, p = <0.001).

When using an independent t-test, a significant difference in favoured stem diameter of host trees was found only for *E. ovata* where the average stem diameter was 273 cm in infested trees, as opposed to 211 cm in non-infested trees (t_{306} = 1.97, p = <0.01) (Figure 3).

The apparent preference for a particular host age/stem diameter displayed by *P. mastersi* at this site would explain why monoculture, single-cohort plantings of suitable host trees (e.g. shelter belts and forestry plantations) can become so heavily infested once they reach the optimal size and thus become highly attractive to ovipositing female beetles.

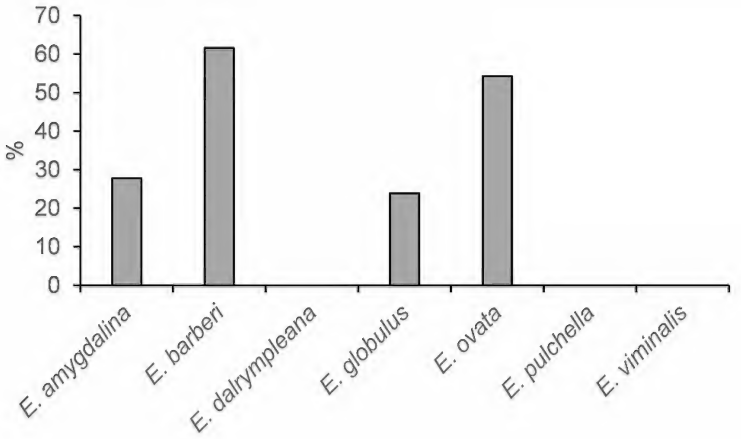

Figure 1. Percentage (%) of each species of *Eucalyptus* tree infested with *P. mastersi* larvae.

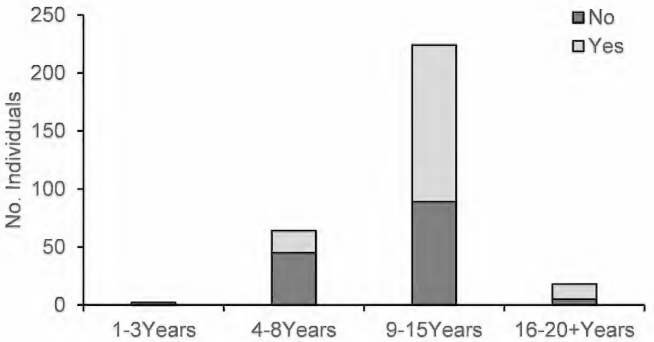

Figure 2. Frequency of *Eucalyptus ovata* trees with or without *P. mastersi* larval infestation across various age categories.

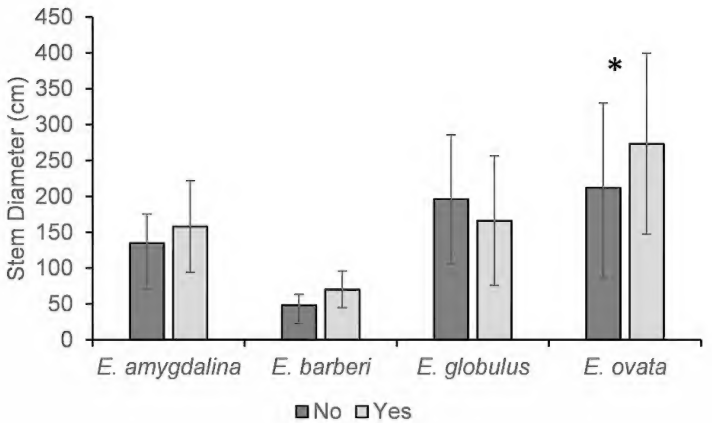

Figure 3. Mean stem diameter (± SD) for *Eucalyptus* trees with or without *P. mastersi* larval infestation. * Statistically significant.

Acknowledgements

Thanks to Matthew Baker at the Tasmanian Herbarium for his help with host tree identifications, Simon Grove (TMAG) for supplying valuable label data from *Phoracantha* specimens in his care, Roger de Keyzer (Australian Museum) for reviewing the manuscript and supplying some references, Adam Slipinski (Australian National Insect Collection) for clarifying the name of *Phoracantha lata*, Angela Casey for producing Plate 1 and Alastair Richardson of *The Tasmanian Naturalist* for editorial advice.

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A picture's worth fifty words

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In *The Tasmanian Naturalist* Number 134 (2012), Simon Grove wrote an article called "A Picture's Worth Sixty Words", in which he presented a number of photos of different aspects of Tasmania's natural world coupled with a description of up to sixty words. His work was the inspiration for this article.

One of the joys of being a field naturalist is encountering and appreciating the variety that Tasmania presents – landforms, shorelines, habitats, plants and animals that can be found on even a short excursion. The scale can vary from whole landscapes down to the microscopic.

There is a lot of truth in the saying that a picture is worth a thousand words. Adding a few written words can increase the value of what a picture has captured.

In sharing some of my photographic encounters, I hope others can also find understanding of and enjoyment in the natural world.

Panholes on Mt Rufus (September 2014)

Strong winds on exposed pavements can cause rotating motion in puddles. Like the way water currents in rivers cause potholes, the slow grinding movement of grit rotating in the puddles erodes circular depressions sometimes called panholes. These panholes developed on a subalpine sandstone pavement.

Tors on Mt Wellington (August 2012)

Cliffs made of columns of dolerite are a feature of many Tasmanian mountains. These tors on Mt Wellington, overlooking Kingston, are the tops of eroded columns. Because of weathering and freeze–thaw cycles, those closest to the tops of steep slopes and cliffs have started to topple.

Rime ice on *Baloskion australe* (southern cordrush) (September 2012)

Rime ice forms in sub-zero conditions when windblown water droplets in fog freeze onto the windward surfaces of objects, such as trees and boulders. On the marshy headwaters of the North West Bay River on Mt Wellington, overnight strong winds caused icy fog to sublimate onto cordrushes. Rime ice also covers the stunted *Eucalyptus coccifera* on Thark Ridge.

Red-necked stints *Calidris ruficollis* and a red-capped plover *Charadrius ruficapillus* (February 2014)

Red-necked stints flock over Southport Lagoon. These small birds, typically 150 mm in length, breed in northern Siberia and migrate south in the northern winter. They are a common sight in Tasmania's summer, especially around mudflats, estuaries and coastal lagoons.

Blue gums on Cape Tourville (June 2014)

The Tasmanian blue gum (*Eucalyptus globulus*) is Tasmania's floral emblem. It can grow as high as 70 metres. On the windblown Cape Tourville, the harsh conditions and thin granite soils have resulted in a local variation that forms compact, attractive bushes only a few metres high.

Pencil pine seedlings in sphagnum moss (June 2014)

Pencil pines (*Athrotaxis cupressoides*) can live to be more than 1,000 years old. They reproduce either by seed or clone from suckers. These youngsters, photographed shooting through *Sphagnum* sp. on the Mt Hugel plateau on a frosty morning, were a few metres from mature pines and could be suckers.

Crown shyness in *Melaleuca ericifolia* (coast paperbark) (October 2014)

In Temma, the coastal canopy is subject to strong winds. One theory of crown shyness suggests strong winds cause branches from neighbouring trees, particularly those with flexible trunks, to crash into one another, and the abrasion prunes the edges of tree canopies, leaving gaps between individuals.

String kelp at Hazard Bay (October 2014)

String kelp (*Macrocystis* sp.) has washed up on the shore of Hazard Bay on the Tarkine coast. It has attracted amphipods, which use it as a food source. As the tide retreated, they have burrowed into the sand around it, digging it up.

Alpine garden on the Mt Anne range (January 2015)

Some high-altitude areas of Tasmania carry a mosaic of plant communities. Cushion plants often comprise many species. Around the cushions grow pineapple grass (*Astelia alpina*), milligania lilies (*Milligania densiflora*), pandani (*Richea pandanifolia*), scoparia (*Richea scoparia*) and alpine heath (*Epacris serpyllifolia*). Surrounding it is rainforest dominated by myrtles (*Nothofagus cunninghamii*).

Calcified Forest in the Tarkine (February 2015)

In the sand dunes north of the Interview River, weird shapes protrude from the sand. This 'forest' was created when calcium carbonate attached to the deep roots of coastal vegetation. Following the dying of the vegetation and sand being blown away, the calcified roots have been exposed.

Frozen Lake St Clair (August 2015)

Below Mt Olympus, several cold winter nights have deposited frost on the frozen surface of Lake St Clair at Narcissus. *Melaleuca* sp. and *Leptospermum* sp. growing in the shallows have absorbed enough sunlight to melt the ice immediately around them only to have it refreeze overnight, creating frost-free circles around them.

Steve in the sky (November 2015)

STEVE (Strong Thermal Emission Velocity Enhancement) is a glowing arc associated with auroras. When it occurs, it is often found with a green-coloured 'picket fence', which is usually also above the main aurora. The photo is from Calverts Beach, looking in the direction of Betsey Island and Goat Bluff.

Summer flowering in the mountains (December 2015)

The firm, smooth surface of alpine cushion plants provides minimum resistance to strong winds and wind-blown snow. During the brief alpine summer, *Dracophyllum minimum* on the King William Range puts flowers up above the surface. Alpine sundews (*Drosera* spp.) also use the opportunity to leaf and flower.

Walking on Water (April 2016)

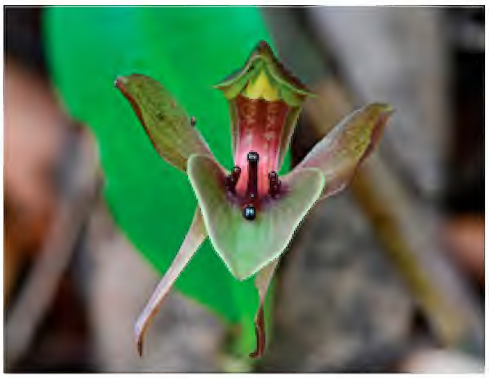
Water spiders of the family Pisauridae are found on the banks of streams, where they sense vibrations caused by insects. Using surface tension, they can walk on water. This one was walking over a small tarn on Tarn Shelf in Mt Field National Park.

Decay of a blackwood (*Acacia melanoxylon*) leaf at Marriotts Falls (May 2023)

On the forest floor, a fallen blackwood leaf has been infected with the disk fungus *Hymenotorrendiella eucalypti*. The tooth fungus, *Dentipellis leptodon*, is spreading over and consuming the leaf and *H. eucalypti*. In turn, a collembolan can be seen on the top right-hand side consuming the *D. leptodon*.

Siphon shells and their egg masses at Eaglehawk Neck (October 2020)

Siphon shells (*Siphonaria* spp.) are common in rock pools and intertidal rocky foreshores, where they graze on algae. They are easily confused with limpets, but they have a characteristic internal siphon groove for breathing. The egg masses are usually laid in a characteristic semicircular fashion.



Large bird orchid (*Chiloglottis valida*) in Strzelecki National Park (October 2022)

Chiloglottis valida was known in Tasmania only from King Island until 2017, when a colony was found in the Dial Range in Tasmania's north-west. Subsequently, in 2021, another colony was found near Smithton. They have now been found in Strzelecki National Park on Flinders Island, further extending its known range.

'Red-bottomed' bee (December 2018)

Exoneura spp., the reed bees, or commonly called 'red-bottomed' bees, are important pollinators of native plants. They nest in burrows made by other insects in wood. They eat nectar, pollen and honeydew. In Douglas Apsley National Park, this bee, while feeding, is pollinating *Calytrix tetragona*, the common fringemyrtle.

Southern snow skinks mating (February 2018)

As the name suggests, southern snow skinks (*Carinascincus microlepidotus*) are found in alpine and subalpine environments as far north as the Central Plateau. Females have a biennial breeding cycle with embryos remaining *in utero* until spring. This couple were found mating at Lake Sirona in the Western Arthur Range.

Hunting the wurgie

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Tasmania has a remarkably large fauna of native earthworms. There are just over 200 described species in 25 genera, all in the family Megascolecidae and all presumed to be endemic to Tasmania.

Most of this diversity was described by earthworm specialist Robert J. Blakemore (2000, 2008). His work was based in large part on earthworm surveys carried out in the 1990s by project officers and volunteers at the Queen Victoria Museum and Art Gallery (QVMAG), Launceston, working under T.J. 'Tim' Kingston (Kingston 2000).

Because many of the described species have very small known ranges, it's highly likely that there are undescribed native earthworms in Tasmania. The story of one of these is told here.

Sharman's tale

On 10 December 1990, Circular Head contractor Tony Sharman was digging a shallow drain in state forest near Roger River West. As he dug, I was pulling earthworms from the freshly exposed mud walls of the new drain, like a seagull following a plough. The worms would later be delivered to the QVMAG in Launceston.

During a break in the drain-digging, Sharman asked me if I had ever seen any giant Tasmanian earthworms. I said yes, there's a big species I'd come across in the north-east, mainly near Weldborough. (It was *Vesiculodrilus tasmanianus* (Fletcher, 1887), which can reach ca 600 mm in length; fully contracted specimens can be 27 mm in diameter and 330 mm long.)

Sharman then told me about an experience he'd had during the construction of the Pieman Road in the 1970s. Near the Wilson River, he lifted his excavator bucket and saw giant earthworms hanging from the rim "like big spaghetti". He didn't see the worms anywhere else on the Pieman Road, but he told me where to look if I wanted to collect specimens.

Confirmation

I didn't get to Sharman's giant earthworm spot until 14 November 1992. On the ground in the rainforest I saw piles of what looked like unusually large earthworm 'castings' (faeces). I had never seen castings that big at any place on the West Coast where I had bushwalked or collected invertebrates. I rang Tim Kingston at QVMAG the same day with the news, and his earthworm survey team visited the area on 1 June 1993 (Kingston 2000: Table 4, Lower Pieman Road site 4). However, no specimens from that location are listed in Blakemore (2000).

On 11 December 1994 my wife and I were travelling on the Pieman Road and stopped at Sharman's locality. Up a steep gully, a landslip had cut a nearly vertical soil profile. We could see dark lines, ca 20 mm wide, meandering up and down the profile, where darker topsoil had filled old burrows in the lighter-coloured subsoil. We could also hear a strange slurping noise from deep in the ground. Had those now-filled burrows been made by giant earthworms, or by burrowing crayfish?

Third visit

My wife and I returned to our 1994 site on 16 February 2023 to see if there were still earthworm signs after 28 years. Dry castings were evident, but the rainforest soil was also very dry – not good conditions for earthworm hunting.

Following this trip I decided to call our target the Wilson River Giant Earthworm, which I shortened to 'wurgie' (pronounced 'whir-ghee') from the acronym WRGE.

Fourth visit

I tried again on 28 August 2023 after good winter rains. This time I was properly equipped for wurgie hunting. I carried a shovel, a trowel and a bottle of homemade vermifuge (mustard powder in water) for tipping down worm burrows.

Fresh castings were abundant in the steep gully, up to 12 mm in diameter and 90 mm long (Plate 1). I dug into the heavy, wet clay of the gully sides, following as best I could the twists and turns of the ca 20 mm diameter worm tunnels. I heard again a slurping sound as worms retreated deeper into the subsoil. Sharman's excavator might have reached the bottom of those burrows and found the big worms, but I couldn't.

The future of the wurgie

Given its small known range near the Wilson River's confluence with Lake Pieman, I suspect the wurgie lost some of its habitat when the lake was first flooded in the 1980s. Fire is a possible threat, but a deep burrower like the wurgie is unlikely to be impacted by the heat of a bushfire. A bigger worry is that fire will eliminate rainforest in the Wilson River catchment as our climate warms and dries, with rainforest being replaced by more open vegetation. Does the wurgie require cool, shady conditions, and food derived from rainforest litter?

If the wurgie is indeed a new species and is someday collected and described by an earthworm taxonomist, an appropriate species epithet would be *sharmani* for its first known finder, Tony Sharman, who died several years ago.

For an excellent and readable overview of earthworms in Australia and their biology, I recommend Blakemore's page on the Australian Museum website (Blakemore 2019).

Plate 1. Two piles of fresh castings imaged on 28 August 2023. The 20c coin in both images is 28 mm in diameter.

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Bird and other vertebrate sightings on a boat trip from Southport to Eddystone Rock, Pedra Branca, the Mewstone, The Needles, Maatsuyker Island, Pinnacle Rock and Flat Top Island, 13 March 2023

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This trip was one of a series from Southport on MS *Velocity* with Skipper Dave Wyatt and his son Albert as deckhand. On Monday 13 March 2023, after a series of wild weekends, there was a window of suitable weather. We launched at 6.50 am with 1- to 2-metre swell and 60% cloud cover. There were 12 passengers on board.

From Southport to Eddystone Rock, we recorded a flock of 3,000 Short-tailed Shearwaters, 10 Silver Gulls (*Chroicocephalus novaehollandiae*), 19 Buller's Shearwaters (*Ardenna bulleri*), 19 Australasian Gannets (*Morus serrator*), 19 Kelp Gulls (*Larus dominicanus*), 25 Greater Crested Terns (*Thalasseus bergii*), 6 Shy Albatross (*Thalassarche cauta*), one Buller's Shearwater (*Ardenna bulleri*) 11 Fluttering Shearwaters (*Puffinus gavia*), 2 Flesh-footed Shearwaters (*Ardenna carneipes*), one Buller's Albatross (*Thalassarche bulleri*), one Black-browed Albatross (*Thalassarche melanophris*), one Cape Petrel (*Daption capense*) and 2 Northern Giant Petrels (*Macronectes halli*). There was also one Australian Fur Seal (*Arctocephalus pusillus doriferus*).

Arriving at Eddystone Rock at 8.55 am, we recorded one Buller's Albatross, 3,000 Short-tailed Shearwaters (*Puffinus tenuirostris*), one Greater Crested Tern, one Shy Albatross, one Australasian Gannet and one White-chinned Petrel (*Procellaria aequinoctialis*).

From Eddystone Rock, we headed towards Pedra Branca that was lit up by the sun. We counted 12 Silver Gulls and 30 Australasian Gannets on the south side of Pedra. There were thousands of Australasian Gannets on the north side. In addition, we counted circa 100 Australian Fur Seals (*Arctocephalus pusillus doriferus*) with a few New Zealand Fur Seals (*Arctocephalus forsteri*) in the mix. There were 15 adult Shy Albatross circling Pedra Branca and 18 juvenile Shy Albatross on the island. From later analysis of photographs, Ryan Francis and I discovered a total of 3 Pedra Branca Skinks (*Carinascincus palfreymani*) basking on the warm rocks. From his photos, Ryan also noticed two small camouflage-coloured cameras fixed to the rock not far from the skinks.

At about 9.30 am we headed towards the Mewstone, counting 1,000 Short-tailed Shearwaters, 4 Shy Albatross,

47 Australasian Gannets, 20 Silver Gulls, 25 Black-faced Cormorants (*Phalacrocorax fuscescens*), circa 200 Fairy Prions (*Pachyptila turtur*), one White-chinned Petrel, one Fluttering Shearwater and 3 Common Diving Petrels (*Pelecanoides urinatrix*).

We arrived at the Mewstone at 12 noon. The rock was covered by thousands of adult Shy Albatross and thousands of chicks. Many nests were low to the water, giving us all great views. Other birds included 47 Black-faced Cormorants, circa 10 Silver Gulls, one Buller's Albatross, 2 Australasian Gannets and thousands of Short-tailed Shearwaters.

After a few slow turns around the Mewstone, we headed to The Needles, where we watched a Peregrine Falcon (*Falco peregrinus*) chasing a Kelp Gull. Around The Needles we counted 25 Black-faced Cormorants, 6 Forest Ravens (*Corvus tasmanicus*), circa 1,000 Short-tailed Shearwaters and 30 Common Diving-Petrels.

We arrived at Maatsuyker Island at 1.10 pm. A single Grey Currawong (*Strepera versicolor*), 4 Pacific Gulls (*Larus pacificus*), 19 Silver Gulls and 47 Black-faced Cormorants were counted around the island and at the haulage area we watched 28 Australian Fur Seals and 2 Pacific Gulls. There was a small colony of Silver Gulls on Pinnacle Rock.

At Flat Top Island we counted 13 Black-faced Cormorants and 2 Pacific Gulls. The boat left Flat Top at 2.50 pm. Following the coast from there to Southport we recorded one Australasian Gannet, 1,000 Short-tailed Shearwaters, one Sooty Shearwater and about 50 Crested Terns. We also counted a total of 28 Common Diving Petrels that leapt out of the water as we passed by and were a fun challenge to photograph. We docked at 5.50 pm at Southport jetty and there was a vote of thanks to Dave and Albert for a great day out.

Acknowledgements

Thanks to Ryan Francis and Ray Pierce for helping keep the species list, and to Michael Dempsey for his support in the organising of the trip. A special thanks to our skipper, Dave Wyatt, and Albert Wyatt for looking after us.

Species list: day trip to Pedra Branca, Mewstone, Maatsuyker and Flat Top islands, 13 March 2023 (IOC taxonomy v.10)

Diomedeidae: albatross

Shy Albatross (*Thalassarche cauta*)

Buller's Albatross (*Thalassarche bulleri*)

Black-browed Albatross (*Thalassarche melanophris*)

Procellariidae: petrels and shearwaters

Northern Giant Petrel (*Macronectes halli*)

Cape Petrel (*Daption capense*)

Fairy Prion (*Pachyptila turtur*)

White-chinned Petrel (*Procellaria aequinoctialis*)

Buller's Shearwater (*Ardenna bulleri*)

Short-tailed Shearwater (*Puffinus tenuirostris*)

Flesh-footed Shearwater (*Ardenna carneipes*)

Fluttering Shearwater (*Puffinus gavia*)

Pelecanoididae: diving petrels

Common Diving Petrel (*Pelecanoides urinatrix*)

Sulidae: gannets and boobies

Australasian Gannet (*Morus serrator*)

Phalacrocoracidae: cormorants and shags

Black-faced Cormorant (*Phalacrocorax fuscescens*)

Laridae: gulls and terns

Silver Gull (*Chroicocephalus novaehollandiae*)

Pacific Gull (*Larus pacificus*)

Kelp Gull (*Larus dominicanus*)

Greater Crested Tern (*Thalasseus bergii*)

Falconidae: falcons and caracaras

Peregrine Falcon (*Falco peregrinus*)

Corvidae: ravens and crows

Forest Ravens (*Corvus tasmanicus*)

Artamidae: woodswallows, butcherbirds and allies

Grey Currawong (*Strepera versicolor*)

Otariidae: fur seals

Australian Fur Seal (*Arctocephalus pusillus doriferus*)

New Zealand Fur Seal (*Arctocephalus forsteri*)

Scincidae: skinks

Pedra Branca Skink (*Carinascincus palfreymani*)

Beddomeia hermansi Ponder & Clark, 1993 (Mollusca: Tateidae) – reviewing a translocation to save a species

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Plate 1. The endemic Viking Creek freshwater snail *Beddomeia hermansi* Ponder & Clark, 1993 (Mollusca: Tateidae)

The endemic Viking Creek freshwater snail *Beddomeia hermansi* Ponder & Clark, 1993 (Mollusca: Tateidae) is currently listed as Endangered under the Tasmanian *Threatened Species Protection Act 1995* (TSPA) (Plate 1). The species (formerly attributed to the family Hydrobiidae) was originally listed as Rare under the Tasmanian TSPA in 1995, but its status was revised and uplisted to Endangered in 2008, due to its restricted range and ongoing stochastic threats. During an exercise to prioritise recovery actions for Tasmania's threatened species (TSS 2009), experts designed a prescription to secure *B. hermansi*, which was ranked 17th in the priority list of 171 Vulnerable and Endangered Tasmanian species assessed. The prescription included translocation of individuals or egg capsules to two new sites likely to fall within the species' suspected historical natural range (2 km from the known locality, in the same catchment). This was identified as a highly feasible, low-cost recovery action. In 2014 a project was undertaken to establish additional populations of *B. hermansi* through translocation to assist in the recovery of the species.

Beddomeia hermansi is known only from a single locality in Viking Creek (type locality), a headwater stream running through private property near Sprent, south of Devonport in central northern Tasmania (Figure 1). It is confined to a 20 m reach of stream about 1.5 m wide (Plate 2 a, b), located between two manmade impoundments which support large populations of the exotic aquatic snail *Potamopyrgus antipodarum* (J.E. Gray, 1843). The site is heavily impacted by trampling and related effects of cattle

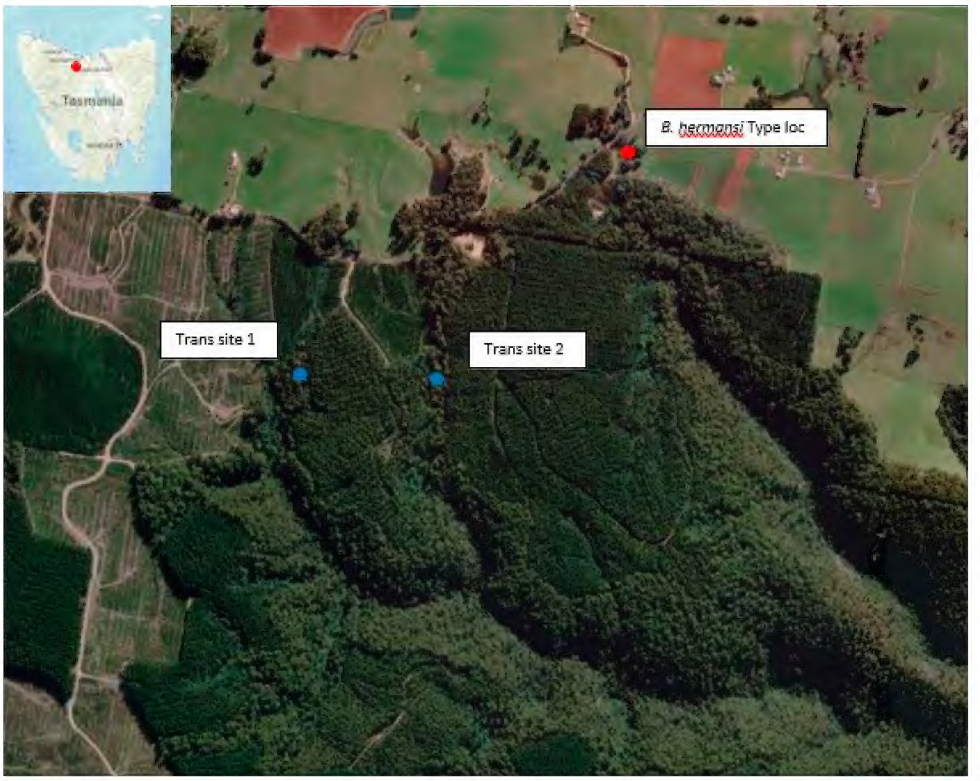

Figure 1. Locality in Viking Creek (type locality), near Sprent, south of Devonport, Tasmania, including two translocation sites

Plate 2 a, b. The type locality of *Beddomeia hermansi*: a. looking upstream from central point; b. looking downstream – total site length 20 m

grazing, declining water quality, and competition from *P. antipodarum* above and below the 20 m reach. In the early 2000s, the adjacent agricultural land was identified as potentially suitable for plantation forestry, thus prescriptions for the management of the species were included in the management tools (Threatened Fauna Adviser) (FPA 2001) implemented through the Tasmanian forest practices system.

Beddomeia hermansi was first collected in 1989, and described in 1993 (Ponder et al. 1993). The historical extent of the *B. hermansi* population is unknown. Tasmania is a hotspot for radiations of tateid snails (Ponder et al. 1993; Clark et al. 2003), most of which are headwater stream specialists with limited dispersal capabilities. It is therefore likely that this species may not have extended far from its current location, but given their proximity, it is feasible that the species could have inhabited a greater area of the Viking Creek and Paynes Creek upper catchments. Surveys to obtain data on its distribution, habitat and conservation requirements undertaken between 1999 and 2010 resulted in no further populations of the snail being recorded (Richards & Spencer 2011; Richards & Spencer unpublished data). A revisit to the known site in 2010 detected the presence, albeit in low numbers, of the exotic competitor *P. antipodarum*, previously unrecorded at the site, plus the co-occurring endemic species *Austropyrgus juliae* Clark, Miller & Ponder, 2003 and *A. ronkershawi* Clark, Miller & Ponder, 2003, which were noted in 1989 (Ponder et al. 1993). Available habitat both above and below this site has been rendered unsuitable to *B. hermansi*, due to land use changes and competition from the exotic snail, which has superior reproductive and dispersal capabilities, and therefore is likely to outcompete the native species.

Beddomeia species occur on submerged allochthonous material (leaves, small wood pieces) and rocky substrate where available, actively feeding on biofilm (periphyton likely dominated by bacteria). Field observations indicate that *B. hermansi* has a preference for low light conditions, inhabiting the underside and lower margins of rocks and woody debris, and clean water, as is the case for other species of the genus. It is on these surfaces that *Beddomeia* egg capsules are deposited. *Potamopyrgus antipodarum*, however, is more tolerant of poor water quality and maximises habitat usage by feeding on all available substrate surfaces and utilising the upper surfaces of rocks, and the moist banks at the water's edge in full daylight (Ponder 1988; Richards pers. obs.). The effect of competition by *P. antipodarum* on some benthic fauna including chironomids and small Leptophlebiidae and Caenidae (mayflies) has been tested (Schreiber et al. 2002) and found to be negligible or even beneficial, but this does not appear to be the case for *Beddomeia* species (Richards unpublished data).

While no life history information is specifically available for *B. hermansi*, it is presumed to be similar to that of other headwater stream-inhabiting *Beddomeia* species, which are known to breed throughout the year, with no

evidence of a seasonal reproductive peak (Richards 2010). Some *Beddomeia* species have been recorded to live for up to 5 years and they develop slowly, reaching sexual maturity only after 2–3 years (Richards unpublished data), but the longevity and maturation rate of *B. hermansi* are unknown. Likewise, information on the breeding habits of *B. hermansi*, as for most *Beddomeia* species, is limited. However, it is known that *Beddomeia* species reproduce sexually, individuals being either female or male, and deposit individual eggs, contained within a capsule coated in sand grains or, less frequently, wood fragments, but it is not known how many eggs a female can produce, or the frequency. The egg capsules of *B. hermansi* were not formally described when the species was nominated (Ponder et al. 1993); however, images are now available (Plate 3). This breeding behaviour contrasts with that of *P. antipodarum*, individuals of which are all female and reproduce clonally, continuously producing thousands of live offspring in a lifetime.

No information is available on the minimum area, or number of individuals required, to support a self-sustaining population. In 2010, the *B. hermansi* population was maintaining a stable population structure with adults outnumbering other age cohorts in areas of the Viking Creek site less disturbed or not readily accessible to the livestock, the best habitat being on rubble associated with the road culvert outside the paddock fence (an area of <1 m^2). Where cattle access the stream, the quality of habitat available to the snail is poor, being trampled and upturned, exposing snails and egg capsules to the air and sun. *Beddomeia* and their egg capsules do not survive out of water for long, particularly when exposed to direct sunlight or high temperatures, egg capsules dehydrating and become fragile in less than five minutes. Removal of the riparian overstorey vegetation, which has been progressively occurring since I first visited the site in 2000, has increased water temperature and reduced water quality through increased algal growth.

All the evidence suggested the species was fast approaching extinction without intervention. The low cost and simplicity of translocation was in the species' favour. This is a report on the project outcomes.

The population assessment and extension surveys leading to the translocation were funded by NRM North in 2009–10 (Richards & Spencer 2011). In 2010, 20 individually marked and numbered rocks (using cable tie and numbered aluminium tag) were introduced to the type locality stream to gauge egg capsule deposition rates in preparation for a potential translocation (Plate 4). At this time, there were concerns about depleting the source population or its habitat, so the transfer of egg capsules was chosen over relocation of adult snails to avoid reducing the population density. Before introducing the new substrate to the stream, individual rocks were closely inspected and cleaned to ensure they were free of other molluscs or their egg capsules.

In 2011 and 2012, the marked rocks were revisited to determine *Beddomeia* uptake.

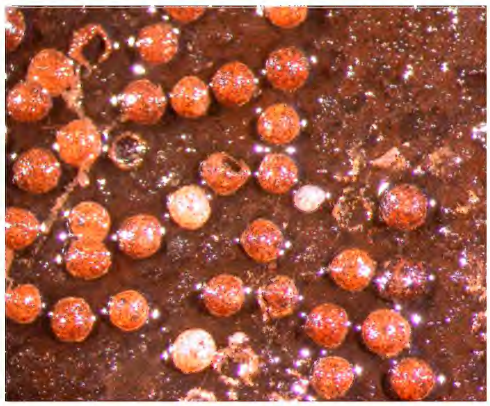

Plate 3. Egg capsules of *Beddomeia hermansi*; size 0.80–0.95 mm

Most were found to be supporting healthy aggregations of *Beddomeia* egg capsules in 2012, indicating they were ready to be moved to the new localities if a translocation was deemed appropriate. By the time a translocation proposal for *B. hermansi* was developed and approved by DPIPWE (now NRE Tas) in June 2014, all rocks supported numerous *Beddomeia* egg capsules.

Translocation sites were selected using desktop analyses to identify a number of potential streams in the immediate catchment of the species. Field assessments were conducted to ascertain presence or otherwise of aquatic molluscan fauna; sites were excluded based on the presence of existing *Beddomeia* species or substantial populations of *Austropyrgus* or *P. antipodarum*. The two most suitable streams showed no evidence of native mollusc species or *P. antipodarum*, although low numbers of *Austropyrgus juliae* were identified at one site; a species relatively common and widespread in the central north of Tasmania, and

Plate 4. Images of tagging habitat rock containing *Beddomeia hermansi* egg capsules

already co-occurring with *B. hermansi* at the known site (Clark et al. 2003).

In addition to the aquatic mollusc fauna in the potential translocation streams, site selection was influenced by proximity to Viking Creek and permanence of flow. The final selected streams are located in the headwaters of two adjacent tributaries of Paynes Creek, 1.5 km to the west of the known locality (see Figure 1). The catchment size of each recipient stream above the selected translocation sites is less than 50 ha and has similar underlying geology. Both streams flow through areas converted to plantation, either *Pinus radiata* or *Eucalyptus nitens*. While not pristine, substantial intact riparian zones had been retained and the water quality (turbidity, temperature and flow) was considered suitable.

Prior to translocation, each rock was examined using a microscope or large magnifier to detect presence of any aquatic snails. Three people (Clare Hawkins, Chris Spencer and I) processed the rocks to minimise the time that egg capsules were out of the water; a spray unit was used to maintain rock moisture. In order to maintain the current snail population at the known site, all adult and juvenile snails were painstakingly removed from the rocks and returned to Viking Creek. In this way, the naturally occurring available habitat (rocks) and the snail population at the known locality were not reduced, even if removal of egg capsules constituted an overall loss of potential offspring.

The clean habitat rocks were separated into two lots of 10 and placed in 50 L crates, into which water taken from the source stream was added to ensure that the egg capsules remained hydrated and cool (Plate 5a). Handling was reduced to a minimum to prevent desiccation.

The habitat rocks with their egg capsules were then transferred to the translocation streams, using a 4WD vehicle to transport the crates as close as possible to recipient streams. Then the crates – minus water, because of its weight – were carried to the selected sites (Plate 5b). The rocks were then randomly placed in a 5 m stretch of stream (Plate 6). The transfer of the cohort of unhatched eggs was completed on 24 July 2014.

The pre-translocation assessment undertaken in 2010 obtained baseline population data for *B. hermansi*, using a method successfully employed to monitor trends in other *Beddomeia* populations (Richards 2010; Richards & Spencer 2011), which resulted in a high level of confidence in the data. The translocation sites were revisited in 2016 (KR & CPS), two years post-translocation, confirming a healthy population of *B. hermansi* in one of the streams. Not only was there evidence of a sub-adult *Beddomeia* cohort on the translocated rocks at the site, but specimens were also present on nearby habitat. The translocation to the second stream, however, proved to be less successful, since five of the ten rocks became stranded above the water line, and the egg capsules desiccated. Of the remaining five rocks, two were partially buried and one was unrecovered; but,

Plate 5 a, b. Transporting habitat rocks to translocation sites

Plate 6. Placing habitat rocks *in situ* at translocation site 2

positively, there was some evidence of snails hatching on the other two rocks, on which there were low numbers of *Beddomeia*, although many egg capsules were unhatched.

The sites have thus far not been revisited, but it is hoped that future monitoring will be conducted at both the type locality and recipient streams to determine the success of the translocation. Success would be measured by detection of multiple age cohorts of *Beddomeia* at the recipient sites. Population assessment, using the methodology provided in Richards and Spencer (2011), could provide clarity of population structure (i.e. how many size cohorts are present) and relative abundance. However, the method is intrusive, and so at this stage we will assess visible snail densities to determine whether conducting a detailed assessment is appropriate. The detection of recently deposited *Beddomeia* egg capsules would be sufficient to confirm the ongoing survival of the species.

A final note to this story: upon learning of the plight of *B. hermansi* in 2014, Joel Roberts composed "Spirals: expansion/ contraction"– a score for Brass Quintet, dedicated to the Viking Creek freshwater snail. Such an outpouring of affection for a species under the radar of most people was heartwarming, a deed to which I offer my gratitude; after all, how many other threatened species have been afforded such an honour?

Acknowledgements

My sincere thanks to Dr Clare Hawkins, and my late partner Chris Spencer, for their devotion to 'my snails', field assistance, and to this project. Thanks to Joel Roberts for writing the snail score, and again to Clare, for inspiring Joel Roberts to undertake his artist endeavours. A special thanks to NRM North, without whose initial interest in the plight of threatened species this project would not have been achieved.

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Laud of the flies

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For many people, the word 'fly' goes hand-in-hand with 'pesky', probably because the insect they have in mind is the bushfly, blowfly or housefly. Mosquitoes are also flies, and there's little that's positive to say about them, despite (or maybe because of) their pivotal role in human history. Yet these nuisance, and even outright dangerous, flies are an extreme minority in an Order comprising millions of species. There are many thousands in Tasmania alone and, for me, their sheer diversity of form, behaviour and lifestyle is part of their appeal.

Much has been made of the idea that, in our modern lives, we are seldom more than a few metres from a rat; but the same can be said of flies. Indeed, there is a tiny scuttlefly crawling on my computer screen as I type these words. But you haven't heard of scuttleflies? This particular one is a member of one of the most speciose genera in the animal world – there are at least 1,700 described species of *Megaselia*, as well as countless more still out there, awaiting description. Indeed, one taxonomic wit has described this scuttlefly genus as 'open-ended', since the true number of species is currently incalculable. And within the genus, its various members embrace a broad range of lifestyles, counting amongst themselves predators, parasitoids, kleptoparasites ('cuckoos'), and more. Flies, you see, are much more interesting inhabitants of our world (or theirs, really) than rats.

To study flies you really need a net – more than for any other insect group. I seldom leave home without one if I'm going bush during summertime. A standing joke in our household is that I'm having an affair with 'Annette', such is the degree of my attachment to this useful implement. When out with Annette, I'm often asked if I'm collecting butterflies. But, no, I'm more interested in flies, I reply. This flummoxes most people and usually brings the conversation to an end; but sometimes it initiates a bit of a discussion about the wonders of flies, and of insects in general, and how little we still know about them.

A standard netting technique that I employ is called sweep-netting. It involves sweeping a net back and forth through, or over, vegetation, then peering inside to find out what's been caught. There's a knack to sweep-netting, which takes advantage of insects' usual tendency to head upwards and towards the light when fleeing. The most productive sweeps involve a series of forthright but carefully aimed strokes; preferably as slight downstrokes. Then, to ensure one's catch remains caught in the net, it's best to flip the bag end

of the net over at the conclusion of a series of sweeps, and leave it that way until one is ready to take a closer look. Since most of the insects that interest me are small, I can't see them through the white netting. This means I must insert my whole head *and* one hand, bearing a specimen tube, into the mouth of the net. To do so, I must let go of the handle, so that the whole thing is held in place by resting on the crown of my head. My other hand holds the bag end of the net out and a little up, which encourages the insects within to congregate at that end, rather than making a dash past my ears to the exit. I find it interesting to observe how the behaviour of passers-by changes when they see me in this state. Most wisely give me a wide berth.

There are so many interesting flies and fly encounters that I could write about here, but I will limit myself to one memorable December day of dipterology. This particular outing was on one of those glorious days, perfect for entomology, with clear blue skies and a gentle breeze. Such days have me itching to head for the hills, just me and Annette. On this one, I set my sights on Wombat Moor – beautiful, peaty-pooled and runnelled open country, on the high saddle that the road to the ski slopes of Mount Field passes over, between Lakes Fenton and Dobson. Bright orange poles on either side of the road helpfully indicated that, today, the snow depth was zero. It isn't always the case, even in summer. Instead of snow, a heat haze was generating mountain mirages, which hovered incongruously above the road. I parked in the layby for the walk to Lake Belcher. Opening the car door invited in the sounds of the moorland: bleating Tasmanian froglets, zizzing mountain cicadas, chirruping pygmy crickets and buzzing marchflies. I sat there for a few minutes, reacquainting myself and mentally recalibrating. Then I donned my boots and gaiters, took Annette in hand, and ventured forth. Turning my back on the boardwalk, I crossed the road and strode out across the moor instead. The ground was pleasingly soft underfoot, verging on squelchy in places – just as it should be in a place like this.

One of the tributaries of the Tyenna River has its headwaters on Wombat Moor, but the gradient is so slight that much of the moor is an intimate mosaic of incipient shrubland, sphagnum-lined pools, peaty trickles and rivulets. It's perfect fly country. I say that because many flies, especially those of the more ancestral lineages, have aquatic larvae. Even later-evolved lineages that are not strictly aquatic tend to have soft-bodied larvae, which are vulnerable to drying out. Therefore, hydrologically well-endowed areas like Wombat Moor are much favoured, although the Moor experiences rather more cold weather, with cycles of freezing and thawing, than is ideal for maximum fly diversity; so the flies there are, by necessity, a hardy lot.

Up ahead, I spied a pool partly overrun with sphagnum moss. I squelched my way towards the shoreline, where some protruding dolerite slabs enabled me to tread close to the water's edge without damaging the fragile habitat or getting

my feet wet. Flies of several distinct types were patrolling a few centimetres above the pool's surface. The smaller ones were midges of various descriptions – meniscus midges and other non-biters. The larger ones – slender but stocky flies about a centimetre long – were danceflies (families Empididae and Hybotidae), which are so called because the males often form mating swarms that dance around bushes and above pools such as this one. I netted some for a closer look and found that there were several species, and that all were males – which are identifiable by their abruptly swollen terminal segments. All had dark bodies and smoky-dark wings. This is common in flies inhabiting cold areas, where the dark coloration may help them rapidly absorb heat whenever the sun shines.

In one of the species (in the genus *Hilara*), the basal segment of the front feet was inordinately swollen (Plate 1).

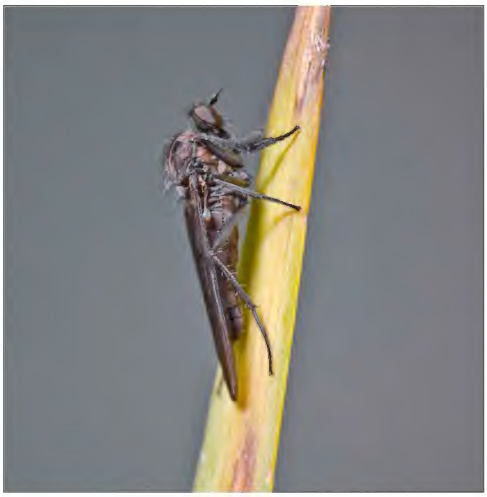

Plate 1. A male dancefly (*Hilara* species), showing the swollen basal segments of the front tarsi where the silk-producing glands are located. Photo by Tony Daley.

I knew that the purpose of the swelling was to house silk-producing glands within the segment. Who knew that flies could produce silk? Male danceflies do so to bundle up a prey item, such as a smaller fly caught on the wing, which will form a nuptial gift for a potential mate. If he doesn't present the object of his attention with a gift, he's at risk of becoming her next meal, pierced by her downward-pointing, needle-sharp proboscis. With a gift, he can keep her front end occupied while their back ends are conjoined in mating. Mating takes place on the wing, but away from the hordes of bachelors. Some males, termed 'sneaky males', adopt a different strategy, dispensing with the prey item and just presenting the female with an empty ball of silk. If he's lucky, she won't notice until they've finished mating. There are also entire species of dancefly in which that's all the males ever do. In these, apparently the females judge the males' merits by the size of their silken balls.

I became aware of a loud and insistent buzzing coming from the middle of the pool, so I swished my net inside out to release the danceflies. This movement caused the source of the buzzing to shift by a metre or so. Its maker was one of our most enchantingly attractive hoverflies, *Austalis pulchella* (Plate 2), whose name roughly translates (with me, at least) as the beautiful little southern dronefly. It's a native relative of the very bee-like European dronefly (*Eristalis tenax*), whose larvae, indelicately known as rat-tailed maggots, sometimes infest septic tanks and crawl around the U-bend to

Plate 2. A female beautiful little southern dronefly (*Austalis pulchella*). Photo by Elaine McDonald.

emerge into toilet bowls when it's time for them to seek a dry place to pupate. Our species has much more refined tastes. It lays its eggs in peaty pools and permanent swamps. The one in front of me was about 15 millimetres long, and it was hovering on the spot, about a metre above the water's surface. It was facing me and very obviously watching my every move through bulging, compound eyes. If I advanced, it retreated by the same distance, only to advance again if I retreated.

The hoverfly was an absolute wonder to watch, not only for its remarkable hovering ability but also for its appearance. Its head, thorax and the first part of the abdomen were a bright golden-brown, with a pair of prominent black spots on the thorax. The rest of the abdomen was a very pale, metallic green-blue, also banded and spotted with jet black. This was the first beautiful little southern dronefly (you see why using scientific names is sometimes preferable) that I had ever seen outside of an insect collection. The fact that the eyes met above the antennae told me that it was a male. In females, the eyes are separated throughout. This is a common pattern in hoverflies and some other fly families; it may reflect the males' need for better spatial awareness and split-action decision-making, since they are the ones that do all the hovering, patrolling and defending of territory, while awaiting the arrival and approval of cruising females.

I cautiously extended my net in the hoverfly's direction; but I think I already knew that this would be in vain. Sure enough, he took fright instantly, and zoomed off to who-knows-where for a couple of minutes; however, he returned, and resumed his hovering in the exact same place. I sensibly decided to let him be – or hover – and moved on to explore fresh fields.

A little further on, where the terrain began to drop gently, a small runnel emptied into a nascent, meandering creek complete with riffles of fine shingle interspersed with quieter pools. I swished over the shingle in the hope of provoking any flies resting there to launch themselves into the path of the net, then performed my head-in-net examination of its contents. Sitting quietly at the far end of the net, amongst scores of tiny midges, was a much larger

Plate 3. A male spotted-winged water snipe-fly (*Dasyomma maculipenne*), photographed at Wombat Moor. Photo by Simon Grove.

fly. At about a centimetre long, it was one that I had forgotten to expect in this country: a water snipefly (family Athericidae). Like the hoverfly, it was my first live encounter with one. I was delighted with my find and how the day was panning out. As with the danceflies, this one, *Dasyomma maculipenne*, had darkened wings (Plate 3). Its specific name translates as spotted-winged. It also had a rather droopy abdomen and held its wings in a sort of V-shape, with the tips resting on the net. This made it look rather down-in-the-dumps, an appearance which persisted even after I coaxed it onto my finger and returned it to a streamside stone. It sat there for a while, still looking miserable, before lazily flying off to another stone a metre or so away. There, it seemed to perk up a bit, perhaps inwardly smiling for the camera that I was now pointing its way. In other respects, it seemed unbothered by all the fuss.

I wondered how water snipeflies ever find mates and keep the species going if all they do is sit around on stones all day. But breed they must, since water snipeflies are a worldwide family. They comprise rather few species, and Tasmania hosts four of them, all of which are endemic to the island. The spotted-winged one before me would have to be the toughest of the lot, as it lives only at high altitudes. The larvae of all species are aquatic and predatory, and the adults seldom venture far from water; which would explain why, thus far, I hadn't swept one from the moorland vegetation.

Pushing on, I made my way towards the flowering shrubs fringing eucalypt woodland at the edge of the moor – teatrees, banksias and hakeas, mostly. Instead of sweeping the bushes with my net, I took to standing and staring. The mass of flowers on the woolly tea-trees was almost blindingly white in the early afternoon sunshine and it took a while for my eyes to become accustomed to the brightness. When they did, I started to discern movement among the flowers. Among the flies, there were danceflies,

Plate 4. A male green-sided soldierfly (*Odontomyia* species), photographed on *kunanyi* / Mount Wellington. Photo by Simon Grove.

bristleflies, blowflies, male marchflies (it's only the females that feed on blood), male mosquitoes (same story) and a few others. And then I spotted the fly that I had been hoping for: a green-sided soldierfly (*Odontomyia* species; Plate 4).

The term 'soldierfly' covers flies of a variety of shapes, sizes, and colours in the same family (Stratiomyidae). The one in front of me – a male, with conjoined eyes – was predominantly black but with a dense coating of brown hairs on the thorax and lime-green sides to its dorsoventrally flattened abdomen. Despite being almost a centimetre long, it was remarkably well hidden among the flowers. I advanced with my camera to my eye, but the soldierfly objected to my intrusion and dashed off, never to be seen again. Since then, however, I have seen what I believe is the same species in the Hartz Mountains, and at The Springs on kunanyi. Many of the black-and-green soldierfly species still lack scientific names, so I couldn't say definitively whether this was one of the described species or not. Some, on the other hand, may have been named more than once, since the males and females tend to have different patterning. The green sides come in various shades from yellowish to almost blue, and can extend, to a greater or lesser degree, towards the centre line of the abdomen, either as broad wedges or narrow bands. All species inhabit wetlands, mostly where the wet vegetation is kept short and lawn-like by wallabies or wombats. This seems to be where they prefer to lay their eggs.

I found many other dipterological delights that day, high up on Wombat Moor, but I think I've written enough to give you the gist of why I chose the title for this article. If you can leave your anti-bushfly prejudices behind, you, too, may find that flies are a laudable lot, worthy of much more positive attention than is their current fate.

Acknowledgements

I thank Elaine McDonald and Tony Daley respectively for allowing me to use their hoverfly and dancefly photos in this article.

[This article is an abridged excerpt from Simon's new book, *Seasons in the South: A Tasmanian Naturalist's Journey of Discovery – and Recovery*, illustrated by Keith Davis, and published by FortySouth. See **Reviews**, page 113.]

New exotic adult host plants for the golden stag beetle *Lamprima aurata* (Scarabaeoidea: Lucanidae) in northern Tasmania

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Introduction

The trophic flexibility of adults of the golden stag beetle *Lamprima aurata* in Tasmania is becoming well documented (Fearn 1996, 2015, 2016, 2017, 2020, 2021; Fearn & Maynard 2018, 2022) with a range of native and introduced plants, shrubs and trees recorded. Adult male *L. aurata* sever shoot tips on host plants with their mandibles to initiate a sap flow where both sexes feed and copulation occurs. The most common adult food plants in Tasmania are eucalypts, particularly saplings and young trees. Five native Tasmanian species have been documented so far – *Eucalyptus viminalis*, *E. globulus*, *E. ovata*, *E. regnans* and *E. obliqua*.

Exotic trees and shrubs appear to be less frequently utilised as adult host trees; however, given the enormous variety of species grown in urban areas, it would be likely that undocumented species are being utilised by adult beetles. So far, Tasmanian *L. aurata* have been found feeding on apricot *Prunus armeniaca* (Fearn 2015) and red-leaf photinia *Photinia* sp. (Fearn 1996). A wide variety of eucalypts native to mainland Australia are also commonly sold in Tasmanian nurseries but none have yet been documented as host species for adult Tasmanian *L. aurata*.

In this paper, two new exotic *Lamprima aurata* host plants are documented from northern Tasmania.

Common lilac *Syringa vulgaris* L.

In late December 2022 the author was made aware of a social media post depicting a pair of *L. aurata* on a common lilac (*Syringa vulgaris*) growing in a suburban garden at Burnie on Tasmania's north-west coast. The property owner was contacted and the author was able to visit the site and document this host plant association.

The property owner reported that the beetles were first noticed on 26 December 2022. The author visited the site on 30 December 2022. The beetles were on the uppermost shoot of a 2-metre-tall, multi-stemmed *S. vulgaris* (Plate 1). Five leaves had been severed by the male, resulting in extensive sap flows from the wounds from which the female was actively feeding (Plate 2).

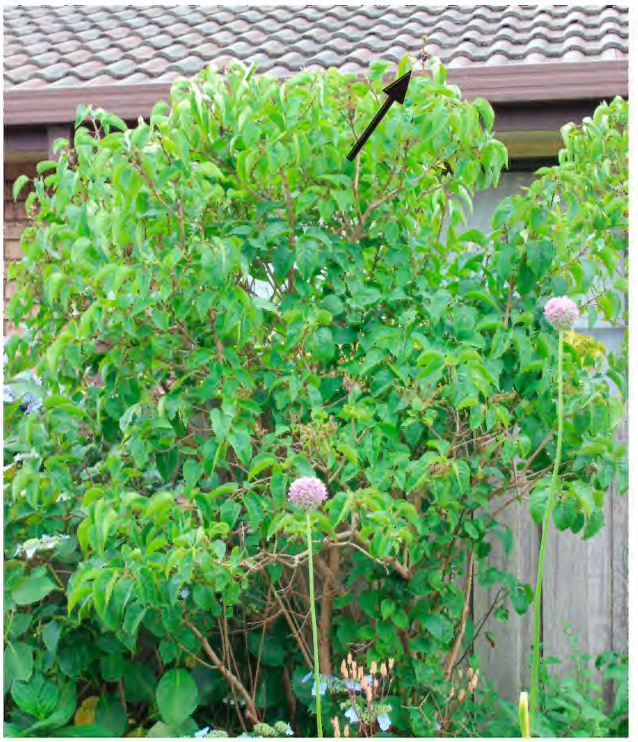

Plate 1. Common lilac *Syringa vulgaris* growing in a suburban Burnie garden. The pair of *Lamprima aurata* can be seen on the protruding terminal shoot at the top right of the shrub (arrow). Photo: S. Fearn.

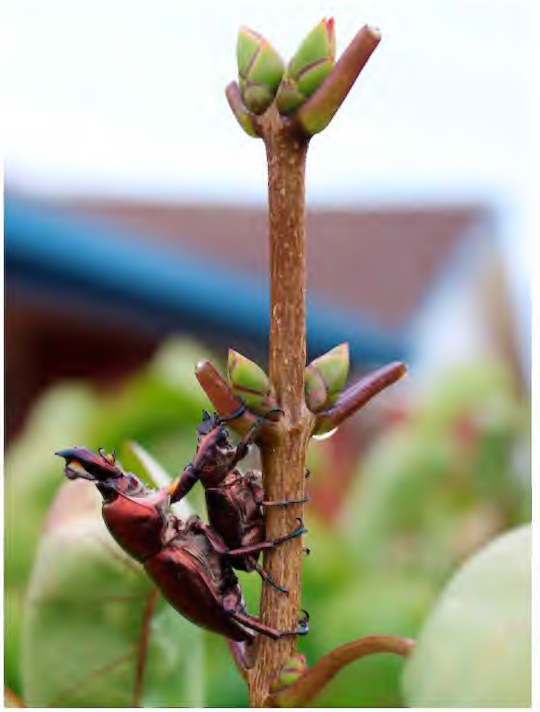

Plate 2. Male (left) and female *L. aurata* on common lilac *Syringa vulgaris*. Note the four severed leaves, extensive sap flow from the severed shoot opposite the beetles, the extreme sexual dimorphism and the typical male defensive posture over the female. The female was actively imbibing sap throughout the photographic process. Photo: S. Fearn.

A series of photographs were taken and the property owner agreed to document how long the beetles stayed feeding on the shrub. The male left on 31 December 2022 and the female on 1 January 2023.

The genus *Syringa*, belonging to the olive family (Oleaceae), includes about 30 species originating from Asia and south-eastern Europe. The most common species widely planted in parks and gardens is the common lilac *S. vulgaris*, native to the Balkan Peninsula in south-eastern Europe and widely grown in temperate regions worldwide (Ilczuk & Jagieaao-Kubiec 2015). *Syringa vulgaris* typically takes the form of a large shrub or small tree growing up to 7 m high and 3–4 m wide.

Shining gum or silvertop *Eucalyptus nitens* (H. Deane & Maiden) Maiden

On 26 December 2022 the author noted adult *L. aurata* beginning to congregate on two specimens of *E. nitens* growing in an urban yard at Beechford, a small coastal town in north-east Tasmania. The author has previously reported on large aggregations of *L. aurata* at Beechford feeding on coast everlasting, *Ozothamnus turbinatus* (Fearn 2016).

By 12 January 2023 an incomplete count was made of 42 adult beetles feeding on severed shoot tips across the two trees; this included many mating pairs.

Both trees were planted twenty years ago and they are now both 6 m tall. They

Plate 3. One of two specimens of *Eucalyptus nitens* growing in an urban yard at Beechford, north-east Tasmania. Photo: S. Fearn.

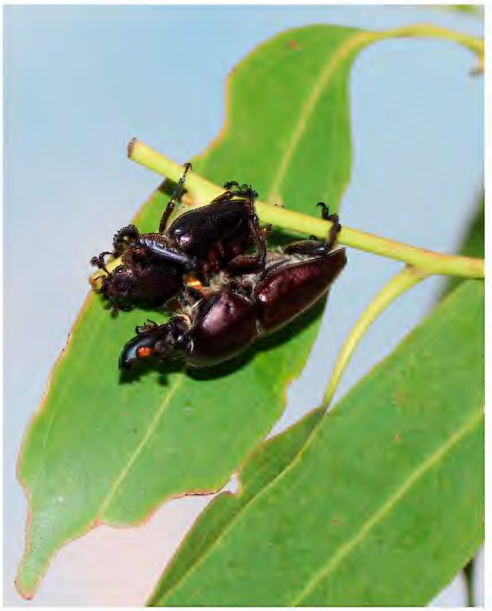

Plate 4. Mating pair of *Lamprima aurata* on *Eucalyptus nitens*. Note both terminal shoots have been cut off by the male and the female is actively imbibing sap flowing down from the cut. Photo: S. Fearn.

Plate 5. Typical male defensive posture over a newly severed terminal shoot on *Eucalyptus nitens*. Male *L. aurata* aggressively defend cut shoot tips and females from rival males. Photo: S. Fearn.

are heavily crown-pruned every three to four years giving them a flat-topped appearance with numerous young shoots of consistent age and length forming the canopy (Plate 3). These shoots were highly attractive to the adult beetles (Plates 4 and 5).

The mating and feeding habits of *L. aurata* in host trees and shrubs have been described in detail elsewhere (Fearn 1996, 2016). The only point of difference observed in these recent observations was that for the first time in some 45 years, the author saw two examples of one male guarding two females at cut shoot tips. Unfortunately, both examples were too high from the ground to obtain photographs. This may have been related to the large numbers of beetles visiting the trees and a limiting resource of favoured shoot tips.

Both trees were occupied by 50+ adult *L. aurata* until mid-February when the beetles began to die off. On 17 February 2023, 22 pairs of beetles were present in the trees with six dead males on the ground beneath. On 23 February, 13 dead males and females were present. By 5 March 2023, only 10 beetles (2 pairs) were active in the trees and by 13 March, only one pair remained with many dead beetles on the ground. The lifespan of emerged Tasmanian adult *L. aurata* is therefore at least 2.5 months. Captive-bred *L. aurata* maintained in a constant optimal temperature regime have lived for 3–6 months (Hangay & de Keyzer, 2017).

Two males feeding on *E. nitens* were collected as voucher specimens and lodged in the Queen Victoria Museum and Art Gallery (QVMAG) entomology collection (QVM:2023:12:2153-54).

Eucalyptus nitens occurs naturally in Victoria on ranges east and north-east of Melbourne at high altitudes, on the east of the Great Dividing Range from the Blue Range, Mt Monda and Mt Torbreck eastwards. It is also found on the high tablelands and mountains of southern New South Wales. There are two widely disjunct populations at high altitude (around 1,500 m) at Barrington Tops and near Ebor in north-eastern New South Wales (Brooker et al. 2006). In Tasmania *E. nitens* is one of the most important forestry plantation tree species along with *E. globulus* (Tasmanian blue gum) and *Pinus radiata* (Monterey pine). *Eucalyptus nitens* grown in Tasmania originate from a single region on mainland Australia, the Central Highlands of Victoria (Gendvilas et al. 2021), and are utilised as a food source by a range of Tasmanian insects, some of significant economic importance such as leaf beetles (Chrysomelidae) (de Little 1989).

Discussion

It is becoming increasingly clear that the trophic ecology of adult *L. aurata* is extremely flexible, involving a wide range of plants, trees and shrubs in unrelated taxa. The list of food plants will undoubtedly grow, especially if 'citizen scientists' become aware of the significance of some of their observations and photographs. This is particularly relevant for the mainland Australian range of *L. aurata*, where very few food plants of the adult beetles have been documented to species level (Fearn 2017; Hangay & de Keyzer 2017). In the author's experience in Tasmania, if mating pairs of *L. aurata* are present on vegetation then they will be actively feeding on it, without exception.

If *L. aurata* are discovered on unfamiliar host plants, it is important to photograph the beetles *in situ* on the host plant as well as photographing its general form and any available diagnostic features such as foliage, buds, flowers and seed-bearing structures. Ideally, in addition to photographs, portions of the plant should be collected and pressed for examination by professional botanists.

Acknowledgements

Thanks to David Maynard for alerting the author to the *L. aurata* feeding on lilac, and Sue Simpson of Burnie for allowing the author access to her garden to photograph the beetles.

Many thanks to Jill and Tony Harding for allowing the author to use their Beechford back yard for stag beetle observations and light trapping over the last two years.

Thanks also to Roger de Keyzer (Australian Museum) for reviewing the manuscript and Alastair Richardson at the *Tasmanian Naturalist* for helpful revisions.

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Highlights of pelagic birding from Eaglehawk Neck 2022–23

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This is the 12th in a continual annual series of articles summarising the highlights of pelagic sea birding off Tasmania's coast. All species lists are available on eBird, where the data is available for analysis by anyone at this stage. For some pelagics, only a species list is given and others show a more comprehensive report. Highlights are the best birds of the day as selected by experienced birders.

From July 2022 to June 2023 there were a record number of 46 trips leaving from Pirates Bay on the Tasman Peninsula on the MV *Pauletta* skippered by John Males. Deckhands throughout the period included Tom Hiney, Bruce Davison, Mitchell Drysdale, Brock Males and Jamie Smith. Trip leaders and report writers were Paul Brooks, Karina Sorrell, Brendan Cook and Aidan Williams, Rob Morris, Mitchell Drysdale, Rohan Clarke, Charuka Abhayawickrama, Mona Loofs-Samorzewski, Peter Kyne, Richard Webber, Dan Mantle, Ben Viola, Peter Vaughan, Ruth Brozek and Tim Bawden.

Monday 4 July 2022: The highlight was a White-fronted Tern (*Sterna striata*).

Sunday 10 July 2022: The many high-lights included a Grey-headed Albatross (*Thalassarche chrysostoma*) as well as a Sooty Albatross (*Phoebetria fusca*) and 3 Light-mantled Albatross (*Phoebetria palpebrata*). In addition, there were a Salvin's Prion (*Pachyptila salvini*), identified from photos after the trip, no less than 14 Antarctic Prions (*Pachyptila desolata*) and 2 Slender-billed Prions (*Pachyptila belcheri*). The final highlight was good views of 2 Grey Petrels (*Procellaria cinerea*).

Saturday 23 July 2022: The highlights were 8 Soft-Plumaged Petrels (*Pterodroma mollis*), 2 Antarctic Prions (*Pachyptila desolata*) and a young Wandering Albatross (*Diomedea exulans*).

Sunday 24 July 2022: This was a quiet day with relatively few pelagic species and very low numbers. Highlights were 2 Southern Giant Petrels (*Macronectes giganteus*) and 6 Providence Petrels (*Pterodroma solandri*), with the trip ending on a high of observing a large mixed pod of 35 Oceanic Bottlenose Dolphins (*Tursiops truncatus*) and 6 Long-finned Pilot Whales (*Globicephala melas*) that were presumed to be feeding.

Saturday 6 August 2022: Highlights were 7 Providence Petrels and 2 Soft-plumaged Petrels.

Saturday 13 August 2022: A Light-mantled Albatross was the highlight and no less than 12 Providence Petrels were seen.

Sunday 14 August: The trip was cancelled due to a heavy storm and flooding.

Sunday 21 August 2022: The most interesting sighting was a White-chinned Petrel (*Pterodroma aequinoctialis*), possibly from the Sub-Antarctic Indian Ocean, with an unusually large white area around the chin, and a pod of 20 Long-finned Pilot Whales that loafed past at a relaxed speed, showing their diagnostic pale saddle. Thirty-four Common Diving Petrels (*Pelecanoides urinatrix*) were mentioned as being a higher than usual number for this species.

Saturday 27 August 2022: The first highlights were 6 White-fronted Terns and one immature Antarctic Tern that was well observed and photographed over several minutes close to the boat. Afterwards, the main highlight was an adult Chatham Albatross (*Thalassarche eremita*) that made several passes close to the boat for over six minutes. A high total of 32 Common Diving Petrels were also reported.

Sunday 28 August 2022: A Brown Skua, one Soft-plumaged Petrel and one Providence Petrel were among the 19 species observed, but there were no outstanding highlights for the day.

Sunday 4 September 2022: The highlights were a leisurely pass made by a first-cycle Grey-headed Albatross; great views of a very cooperative first-cycle Light-mantled Albatross; a close pass from a Blue Petrel (*Halobaena caerulea*); good numbers of 16 Providence Petrels and 8 White-headed Petrels; 2 Northern Royal Albatross and an adult Salvin's Albatross. There were 2 Blue Sharks (*Prionace glauca*) mooching around the berley trail.

Saturday 10 September 2022: There was persistent drizzle, overcast and dull weather with mist to the tops of the cliffs and generally poor visibility. The clear highlight of the day was a Grey Petrel that made several close approaches. Another highlight was of 30 Providence Petrels that approached closely in their typical dash by without stopping.

Sunday 11 September 2022: It was agreed that the highlight was easily the Arctic Tern in breeding plumage. Two Humpback Whales (*Megaptera novaeangliae*) were also seen.

Saturday 22 October 2022: One Antarctic Prion was the probable highlight of the trip. Also seen were at least 4 Humpback Whales.

Sunday 23 October 2022: This was a fairly quiet winter pelagic with no great highlights but the aberrant Sooty Shearwater (*Ardenna griseus*) with a diffuse white neck band and very pale underwings caused some excitement and remained a mystery until it was identified from photos post-pelagic.

Tuesday 1 November 22: Highlights were 3 White-fronted Terns, 8 Wilson's Storm Petrels (*Oceanites oceanicus*) and 4 Grey-backed Storm Petrels (*Garrodia nereis*).

Saturday 5 November 2022: Highlights included a close pass of a Long-tailed Jaeger (*Stercorarius longicaudus*), a White-headed Petrel (*Pterodroma lessonii*) and a Mottled Petrel (*Pterodroma inexpectata*).

Sunday 6 November 2022: A low diversity of petrels was reported although 31 Wilson's Storm Petrels entertained the observers. The highlights were a Long-tailed Jaeger, an unidentified sunfish (*Mola* sp.) and a Blue Shark, the latter which hung around the stern of the boat allowing great surface views. A Black-bellied Storm Petrel (*Fregetta tropica*) was an additional highlight.

Saturday 12 November 2022: A Cook's Petrel (*Pterodroma cookii*) was the highlight of the day. The bird appeared in the slick and hung around for a few minutes with a few nice fly-bys. The unusually languid flight was interesting and photos showed a relatively darker grey hood and strong bleeding of grey onto the flanks.

Sunday 13 November 2022: This trip included 2 Soft-plumaged Petrels, 3 White-headed Petrels, 34 Mottled Petrels, 9 Cook's Petrels, one Antarctic Prion and 37 Buller's Shearwaters (*Ardenna bulleri*) first seen early in the day in inshore waters, and there was a count of 14 while motoring. They were consistently passing throughout the day with up to 6 around the boat at once.

Saturday 19 November 2022: A total of 56 Buller's Shearwaters was a record number for a single day off Eaglehawk Neck. Other highlights included one Salvin's Albatross (*Thalassarche salvini*), one Soft-plumaged Petrel and one White-headed Petrel. Paul also commented on the huge flocks of Short-tailed Shearwaters (*Ardenna tenuirostris*) sighted, including approximately 30,000 inshore, 7,000 offshore and 3,000 in pelagic waters.

Saturday 26 November 2022: Highlights were one Salvin's Albatross and 13 Buller's Shearwaters.

Sunday 27 November 2022: One Salvin's Albatross, 7 Southern Royal Albatross (*Diomedea epomorpha*), 3 Northern Royal Albatross (*Diomedea sanfordi*) and 15 Wilson's Storm Petrels (*Oceanites oceanicus*) were the highlights of the day.

Friday 2 December 2022: A high species diversity included 5 Long-tailed Jaegers, 8 Black-bellied Storm Petrels, 32 White-headed Petrels, 98 Mottled Petrels heading south, 37 Gould's Petrels (*Pterodroma leucoptera*), one Broad-billed Prion (*Pachyptila vittata*) and 2 Antarctic Prions. However, the standout highlight was a vagrant Pycroft's Petrel (*Pterodroma pycrofti*). This species breeds on small islands off the north-eastern coast of New Zealand's North Island and is listed as Vulnerable (see photo next page).

Saturday 3 December 2022: A single Ruddy Turnstone (*Arenaria interpres*) was reported that made a circuit beyond the shelf edge. The group also reported a Brown Skua (*Stercorarius antarcticus*) and 3 Mottled Petrels as highlights.

Sunday 4 December 2022: The group counted at least 13 Long-tailed Jaegers. All were flying roughly north to south – apparently on passage. One of them harassed a Wilson's Storm Petrel in the slick. A Soft-plumaged Petrel, 23 White-headed Petrels and 127 Mottled Petrels were also on passage with some passing close to the boat giving excellent views. Totals of 5 Cook's Petrels, 3 Gould's Petrels, 45 White-chinned Petrels and 7 Buller's

Pycroft's Petrel. Photo from Friday 2 December 2022 by Els Wakefield

Shearwaters were also considered good numbers.

Sunday 11 December 2022: The highlights were one Salvin's Albatross and one Broad-billed Prion, which were described as a rare record for Eaglehawk Neck, but the second in as many weeks. There was a 5-foot Blue Shark loitering around the berley bucket for at least half an hour in pelagic water.

Friday 16 December 2022: A Black-bellied Storm Petrel, no less than 3 Broad-billed Prions and 10 Antarctic Prions were the clear highlights. Five White-headed Petrels, 11 Mottled Petrels, 17 Cook's Petrels and 4 Gould's Petrels were all passing through.

Saturday 17 December 2022: One Salvin's Albatross and 20 Antarctic Prions were reported as highlights. A Soft-plumaged Petrel, 28 White-headed Petrels, 31 Mottled Petrels and 22 Cook's Petrels were all heading south.

Sunday 18 December 2022: The highlights included a Long-tailed Jaeger, 5 White-headed Petrels, 6 Mottled Petrels, 3 Cook's Petrels and 3 Buller's Shearwaters.

Sunday 29 January 2023: This trip featured 7 Oceanic Bottlenose Dolphins and a pod of 17 Short-beaked Common Dolphins (*Delphinus delphis*). A large sunfish was spotted over the slope of the shelf on the way back. The bird highlights included 3 Arctic Jaegers (*Stercorarius parasiticus*), a Cook's Petrel, 5 Wedge-tailed Shearwaters (*Ardenna pacifica*), 86 Buller's Shearwaters, 10 Fluttering Shearwaters (*Puffinus gavia*) and the unusual sighting of 2 Tree Martins (*Petrochelidon nigricans*) at the Hippolyte Rocks.

Saturday 4 February 2023: There was an intermediate form South Polar Skua (*Stercorarius maccormicki*), one Brown Skua and one Arctic Jaeger. Other highlights were 4 Flesh-footed

Shearwaters (*Ardenna carneipes*), good views of a Gould's Petrel, 3 Wedge-tailed Shearwaters and a total of 200 Buller's Shearwaters throughout the day, which Rohan Clarke described as incredible numbers of this species. His trip on the Sunday was cancelled due to rough weather.

Sunday 26 February 2023: Of the 16 species observed, the highlight was a Soft-plumaged Petrel.

Sunday 19 March 2023: A Salvin's Albatross and a close pass of a Great Shearwater were the two highlights of the day.

Sunday 16 April 2023: Highlights were an early Westland Petrel (*Procellaria aequinoctialis*), which we don't usually expect to see for another couple of weeks, and a late Buller's Shearwater that was perhaps not surprising considering the unprecedented numbers that had been in the area for the summer. Also observed was a fin of an unidentified shark that put all the birds on the water around us to the skies. The skipper suspected it to be a Great White Shark (*Carcharodon carcharias*). An unidentified sunfish species broke the surface near the stern of the boat in pelagic water.

Sunday 30 April 2023: This trip enjoyed good light and the highlights were a Westland Petrel that came in close, and 4 Providence Petrels.

Saturday 6 May 2022: Another sunny day offshore resulting in sunburn for those who were unprepared. A total of 70 Buller's Albatross were counted, including about 60 around the Hippolyte Rocks. At the shelf, an unusually high number of 3,200 Fairy Prions (*Pachyptila turtur*) was recorded. The highlights were a Westland Petrel and a Flesh-footed Shearwater at the first berley stop.

Sunday 7 May 2023: The weather was noticeably colder, but there were some nice rainbows. Of the 50 Buller's Albatross observed, most were around the Hippolyte Rocks. A highlight of what was perhaps a third-year Salvin's Albatross hung around the boat. Towards the end of the day the wind increased, which coincided with the visit of a Sooty Albatross that was the biggest highlight of the day. The bird making a couple of long passes provided everyone good views.

Saturday 20 May 2023: The highlight birds of the day were 2 Westland Petrels. On our way back we were treated to a pod of Orcas (*Orcinus orca*) jumping out of the water just outside Pirates Bay.

Saturday 3 June 2023: The highlights were a South Polar Skua (*Stercorarius maccormicki*) and a Grey Petrel. On the way back to shore, a Peregrine Falcon (*Falco peregrinus*) was observed carrying a wing of a bird it had caught as prey over the Hippolyte Rocks.

Sunday 4 June 2023: This pelagic included a Sooty Albatross, 2 Grey Petrels and 2 Antarctic Prions as the highlights.

Sunday 25 June 2023: A Brown Skua, 20 Providence Petrels flying south and 2 Westland Petrels stood out as the highlights.

Acknowledgements

I thank the skipper and the deckhands for keeping us safe, the trip leaders and report writers for their help, and Paul Brooks for his help with writing this article.

Bird and other species list pelagic highlights 2022-2023 (IOC taxonomy v.10)

Diomedeidae: albatross

Wandering Albatross (*Diomedea exulans*)

Southern Royal Albatross (*Diomedea epomorpha*)

Northern Royal Albatross (*Diomedea sanfordi*)

Sooty Albatross (*Phoebetria fusca*)

Light-mantled Albatross (*Phoebetria palpebrata*)

Grey-headed Albatross (*Thalassarche chrysostoma*)

Salvin's Albatross (*Thalassarche salvini*)

Chatham Albatross (*Thalassarche eremita*)

Procellariidae: petrels and shearwaters

Southern Giant Petrel (*Macronectes giganteus*)

Common Diving Petrel (*Pelecanoides urinatrix*)

White-headed Petrel (*Pterodroma lessonii*)

Providence Petrel (*Pterodroma solandri*)

Mottled Petrel (*Pterodroma inexpectata*)

Gould's Petrel (*Pterodroma leucoptera*)

Pycroft's Petrel (*Pterodroma pycrofti*)

Cook's Petrel (*Pterodroma cookii*)

Soft-plumaged Petrel (*Pterodroma mollis*)

Blue Petrel (*Halobaena caerulea*)

Broad-billed Prion (*Pachyptila vittata*)

Salvin's Prion (*Pachyptila salvini*)

Antarctic Prion (*Pachyptila desolata*)

Slender-billed Prion (*Pachyptila belcheri*)

Fairy Prion (*Pachyptila turtur*)

Grey Petrel (*Procellaria cinerea*)

White-chinned Petrel (*Pterodroma aequinoctialis*)

Wedge-tailed Shearwater (*Ardenna pacifica*)

Fluttering Shearwater (*Puffinus gavia*)

Buller's Shearwater (*Ardenna bulleri*)

Flesh-footed Shearwater (*Ardenna carneipes*)

Westland Petrel (*Procellaria aequinoctialis*)

Sooty Shearwater (*Ardenna griseus*)

Hydrobatidae: storm petrels

Grey-backed Storm Petrel (*Garrodia nereis*)

Wilson's Storm Petrel (*Oceanites oceanicus*)

Black-bellied Storm Petrel (*Fregetta tropica*)

Laridae: gulls, terns and skimmers

White-fronted Tern (*Sterna striata*)

Stercorariidae: skuas and jaegers

South Polar Skua (*Stercorarius maccormicki*)

Brown Skua (*Stercorarius antarcticus*)

Arctic Jaeger (*Stercorarius parasiticus*)

Long-tailed Jaeger (*Stercorarius longicaudus*)

Falconidae: falcons and caracaras

Peregrine Falcon (*Falco peregrinus*)

Hirundinidae: swallows and martins

Tree Martin (*Petrochelidon nigricans*)

Cetacea: Mysticeti: BALEEN WHALES

Humpback Whale (*Megaptera novaeangliae*)

Cetacea: Delphinidae: DOLPHINS

Short-beaked Common Dolphin (*Delphinus delphis*)

Oceanic Bottlenose Dolphin (*Tursiops truncatus*)

Long-finned Pilot Whale (*Globicephala melas*)

Orca (*Orcinus orca*)

Actinopterygii: Tetraodontiformes: Molidae: ocean sunfishes

Ocean Sunfish (*Mola* sp.)

Chondrichthyes: SHARKS, RAYS, SKATES AND CHIMAERAS

Blue Shark (*Prionace glauca*) Carcharhinidae

Great White Shark (*Carcharodon carcharias*) Lamnidae

Tasman Island Integrated Biological Survey – Flora Survey 26–31 January 2023

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Introduction

The 'Integrated Biological Survey of Tasman Island' was organised by The Friends of Tasman Island (FoTI) together with Wildcare Inc. and it was the first opportunity for the authors to study the flora of the island in any detail. We joined five other scientists/ field naturalists who were studying snails and other invertebrates, and birds. This was the first integrated field trip since 2005, when the comprehensive Tasman Island Flora and Fauna Survey was conducted as part of the Hamish Saunders Memorial Island Survey Program (HSMISP 2005, referred to as HSMR in the FoTI report). This paper is based on our 2023 report submitted to FoTI (Carle & McEldowney 2023) in which we were able to check and, where necessary, correct identifications or update nomenclature of the records from September 1965 up to the most recent 2018 collections. We also added 11 new species to the Tasman Island flora list.

We were also alerted to the possible presence of an exotic *Carex* species that needed to be located in order to have its identification confirmed.

History of Tasman Island from 1885

The lighthouse

The lighthouse on Tasman Island was manned and operational between 1906 and 1976. It became fully automated in 1976 with the last resident lighthouse keeper leaving in 1977. Subsequently, Tasman Island was subsumed into the Tasman National Park. The area around the lighthouse is now leased by the Australian Maritime Safety Authority for the purposes of maintaining the lighthouse.

Friends of Tasman Island (FoTI)

In 2005 FoTI, under the auspices of Wildcare, was formed to work in partnership with Tasmania Parks and Wildlife Service. The volunteers' aim is to help with the restoration of both the cultural heritage and the natural environment of the island.

At the time of writing, FoTI have held over 30 ten-day working bees on the island during which they help maintain the three lighthouse keepers' brick houses – Quarters 1, Quarters 2 and Quarters 3, known as Q1, Q2 and Q3 (Figure 1). There used to be a fourth building located to the north of Q1. This was the first building on the island

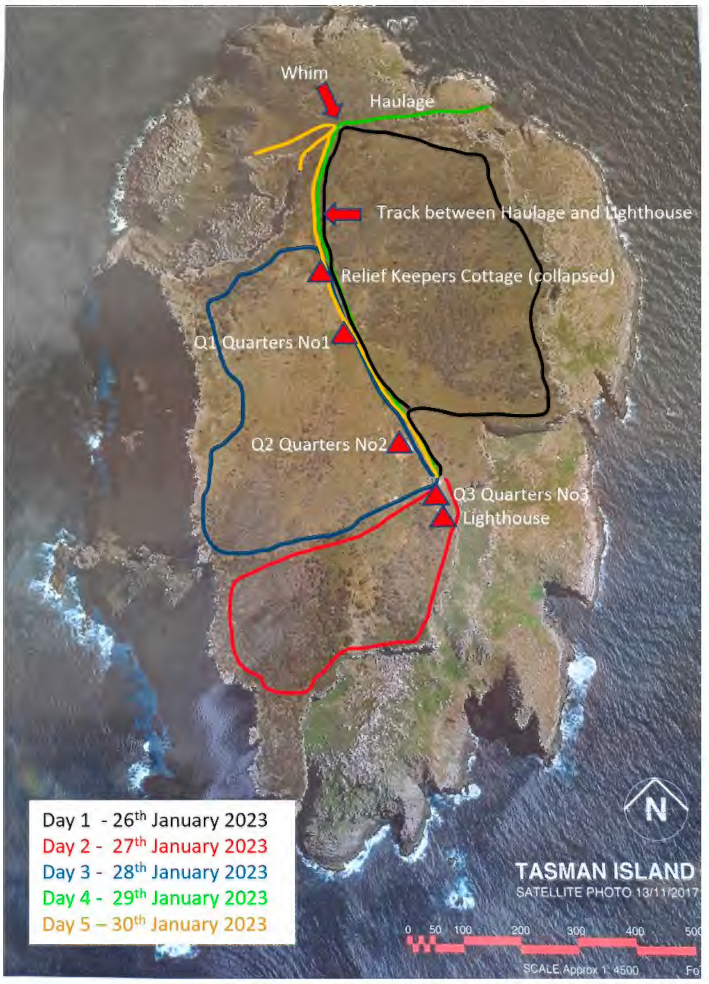

Figure 1. Routes of the daily walks superimposed on a 2017 satellite image from a photograph in Q3.

erected in 1904 as the Clerk of Works Office and was occupied by Mr F. Reynolds. It was built of timber and corrugated iron. After the completion of the lighthouse and the three lighthouse keepers' houses it became used as the relief keepers' quarters. It was also used by the Navy undertaking Coastwatch duties during World War II and to house any unexpected visitors to the island. Although it was still standing in 1977 when the lighthouse keepers left the island, by 2005 it had collapsed (E. Shankley, FoTI Archives; see Plate 1).

One of the aims of the FoTI working bees is to eliminate the weeds introduced during the days when the lighthouse keepers maintained pasture for their livestock. When the keepers left in 1976–77 they also left introduced plants in the gardens surrounding the three keepers' houses, e.g. montbretia, arum lilies, gladioli, hebe, narcissus, aeoniums, sedums and ornamental crassulas, as well as vegetables such as turnip and radish,

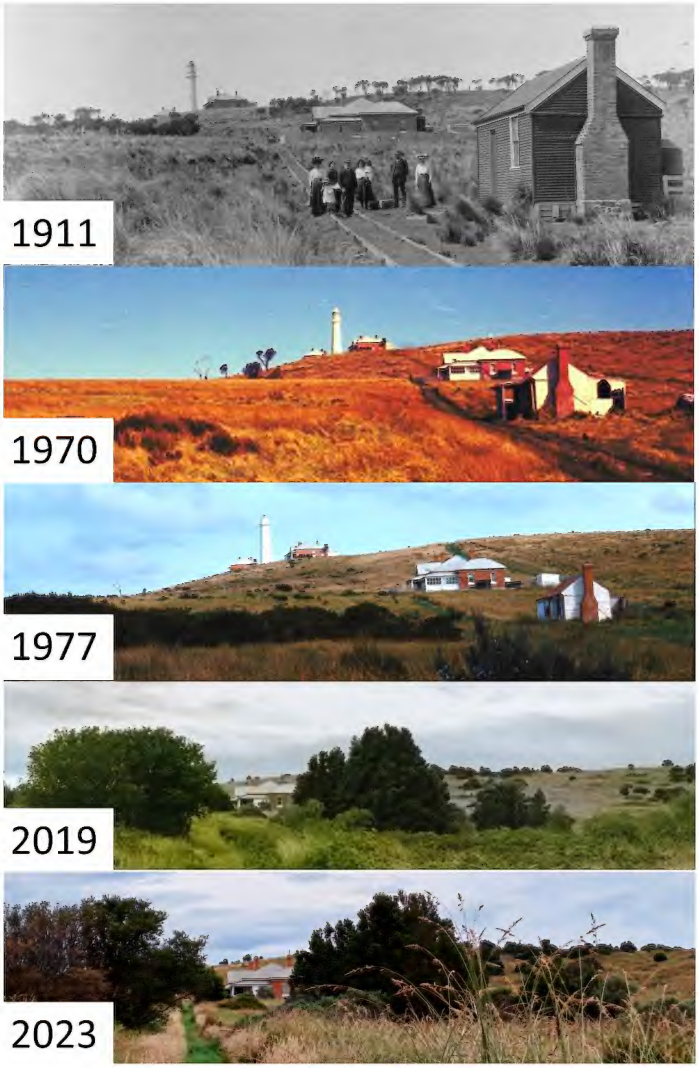

Photo circa 1911. From the Carlene Nillsen collection. Supplied by FoTI.

Photo circa 1970. From the John Cook collection. Supplied by FoTI.

Photo circa 1977. From the John Cook collection. Supplied by FoTI.

Photo circa 2019. Looking south along the track towards Q1, other houses and the lighthouse obscured by vegetation. Photographer unknown. Supplied by FoTI.

Photo January 2023, similar to 2019. Photo: Anna McEldowney.

Plate 1. A comparison of photos taken from near the Relief Keepers' Quarters looking south towards the lighthouse between 1911 and 2023 showing the changes in vegetation.

some of which still persist there or have since spread into the neighbouring vegetation. These are also being targeted and gradually removed by the FoTI weed working bees.

Vegetation

The Mercury on 8 August 1885 reported on the first visit by members of the Hobart Marine Board to look for a site for the lighthouse as follows:

> After attaining the summit of the basaltic cliffs which almost overhang the island on all sides we found ourselves on a table land covered with a stunted scrub almost similar to that found upon Mount Wellington, slightly varied by patches of bull oak and honeysuckle (*banksia*); of the latter thousands of trees were found in a dead or decaying

> state, the surface of the ground being almost entirely covered with them, and the whole was overgrown with grass and stagshorn fern; other ferns were also observed, including the tree fern … From this position a full view to the westward was obtained, but in consequence of some timber near the centre of the island the Hippolyte rocks were not visible. I have no doubt that with a tower about 50ft high, the timber being levelled, an uninterrupted view all round can be obtained, but it will only be necessary to clear as far round to the northward as to enable a light to be seen …

In the early period of manned lighthouse operation, the scrub was cleared for firewood and to make way for grassland for the grazing of sheep, cattle, goats and pigs. Draught horses were also kept for turning the Whim at the top of the haulage to winch supplies, equipment and people from the landing stage at the base of the north-east cliffs to the top, and for transporting supplies from the top of the haulage up to the lighthouse and its residences (E. Shankley, FoTI Archives).

Significant vegetation clearing was required to maintain clear access between and around the lighthouse keepers' quarters and the lighthouse.

Since the automation of the lighthouse, the vegetation has slowly recovered. It has been suggested that in the 45 years since the lighthouse keepers departed, the island's vegetation is returning to a state comparable to that first found on Tasman Island in 1885. The difference is the number of introduced species, in particular of grasses and sedges, which were a result of the days when livestock was kept on the island.

Introduced pasture grasses have remained particularly along both sides of the track from the haulage to the lighthouse and around the buildings. The Tasman Island vegetation communities include areas of heathy scrub, sheoak woodland (which includes the rare and threatened Cape Pillar sheoak, *Allocasuarina crassa*) and increasing amounts of sedgeland and regenerating scrub. However, the extent of vegetation growth since both the 2005 and 2007 surveys has been significant and we found many of the vegetation boundaries were 'blurred' and not as clear-cut as those depicted in the TASVEG 4 map (NRE July 2020) in Figure 2. A comparison of photos taken looking south towards the lighthouse between 1911 and 2023 clearly shows the changes in vegetation over time (Plate 1). It should also be noted that Tasman island's fauna is remarkable in that it does not include any mammals (including rats and mice), snakes or amphibians. Thus, the Tasman Island vegetation is not subjected to the same effects of herbivore grazing as Tasmanian mainland plants.

The average rainfall for Tasman Island is about 800 mm, but in 2022 rainfall of over 1000 mm was recorded at the nearby Fortescue Bay weather station from May until December when the Tasman Island rain gauge was not working (BOM 2023). Despite a relatively dry summer into 2023, the deeper soils and sedgeland areas of the Island were still damp in late January

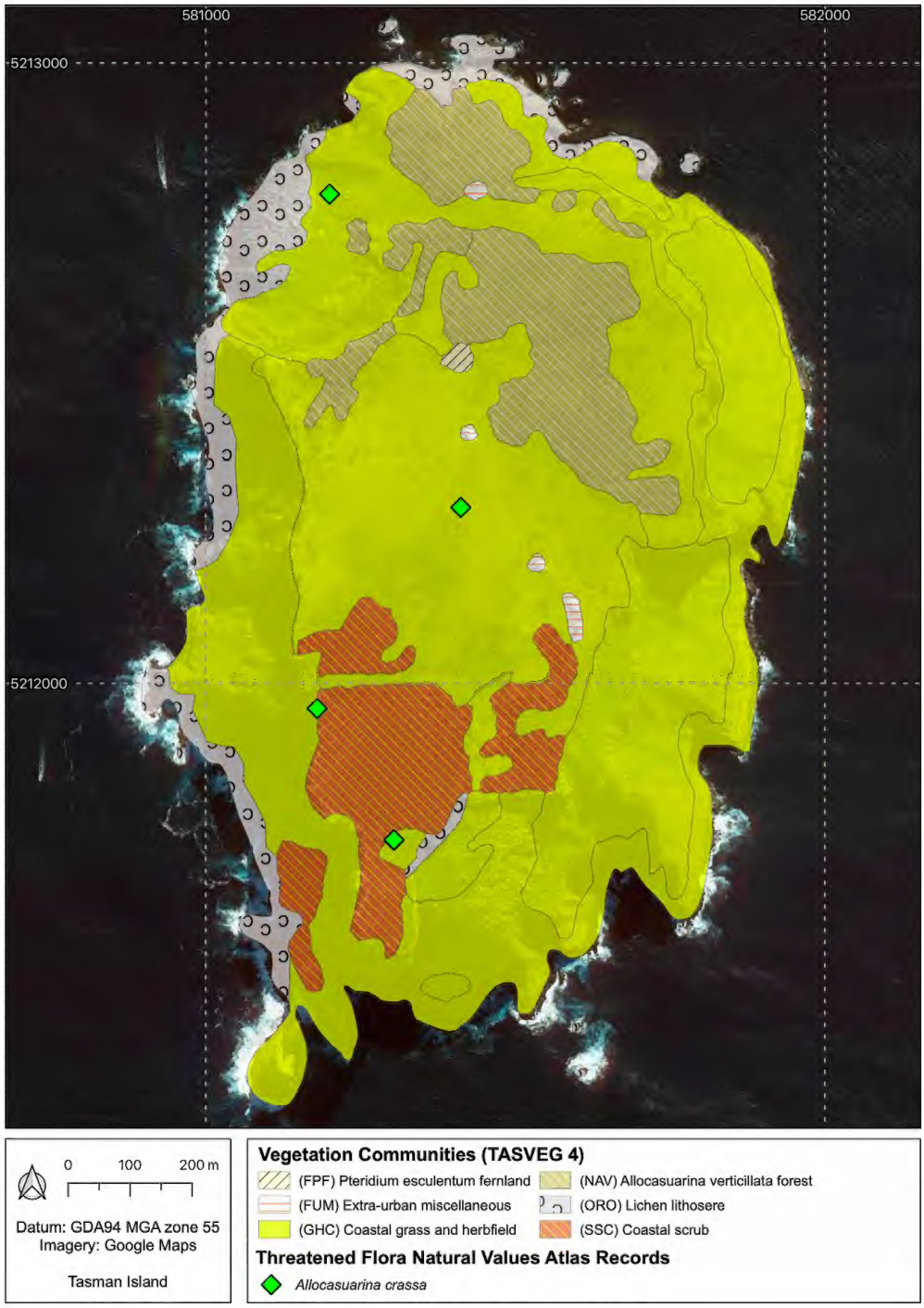

Figure 2. TASVEG 4 map of Tasman Island vegetation communities (source: NRE 2020).

Table 1. List of known Tasman Island flora collectors who added records to the NVA from 1965 to 2018.

Name of Collector	Date of Collection
J. Thwaites	26 September 1965
R.A. Burns	27–29 November 1987
R. Burns	1 April 1990
R. Tyson	9–10 November 2004
P. Tyson	6 March 2005
C. Markby	30 March 2006
S. Leighton	30 June 2006
P. Tyson	22–29 September 2007
R. Tyson	23–29 September 2007
P. Tyson	23 November 2007
R. Tyson	26 December 2007
P. Tyson	9–17 February 2008
R. Tyson	14–17 February 2008
P. Tyson	6 March 2008
D. Reynolds	25 March 2008
R. Tyson	10–15 November 2008
P. Tyson	7 March 2009
R. Tyson	27 November 2012
R. Graham	8 February 2014
H. Hilliard	8 February 2014
M. Wapstra	16 May 2018

2023 from the 2022 winter and spring rains. Plant growth was extensive and we found ourselves 'wading' through sedges and grasses up to 1.5 metres high and pruning back some of the dominant shrubs including *Banksia marginata* and *Pittosporum bicolor*, just to be able to walk through previously known tracks.

Flora Collections to 2022

Table 1 above lists the known Tasman Island flora collectors who added records to the NVA from 1965 to 2018.

In September 1965, Jack Thwaites made the earliest recorded collection of Tasman Island vegetation when he collected a specimen of *Allocasuarina crassa* for the Tasmanian Herbarium (HO).

Three additional collecting trips were made, and although their species records were included in HSMISP (2005), they were not included in the NVA and are

not listed in Table 1. Between 1977 and 1978, Nigel Brothers collected specimens of 100 plant species from Tasman Island which were identified by Mick Brown (Brothers 1979) and later discussed by Brown and Duncan (1989).

On an archaeological trip in 1982, Stephen Harris expanded Brothers's preliminary plant list to 112 species (Harris 1984).

In 2001, a team of staff from the Department of Primary Industries, Water and Environment (DPIWE; now called Department of Natural Resources and Environment Tasmania – NRE) visited the island for three hours to assess the population of threatened *Allocasuarina crassa*. This trip also enabled compilation of a draft vegetation map of the island (Schahinger 2002a, 2002b).

Records from the Tasman Island Flora and Fauna Survey (HSMISP 2005) unfortunately did not include location data, nor were plant specimens collected for submission to HO for subsequent recording on the Natural Values Atlas (NVA); therefore, it was not possible to confirm the identifications of some of those collections.

In 2007 and 2008, Penelope and Robert Tyson, under the auspices of FoTI, undertook two major collection trips. They expanded the number of collected species and submitted specimens to HO which were subsequently recorded on the NVA. Since that period there have been several species added, with the most recent records added to the NVA in May 2018 by Mark Wapstra.

Survey methods

Chris Creese, a long-standing FoTI member who is very familiar with Tasman Island, led us on five daily morning walks around the island (26–30 January 2023). The routes these walks took are shown in Figure 1.

During our five days on the island we were unable to undertake any formal surveys similar to those conducted in 2005. Instead, using the HSMISP flora list and the NVA flora list extracted in January 2023, we were able to note the presence or absence of species along these routes. We aimed to collect both herbarium specimens and data for any native or introduced species **not** already on the NVA list as at January 2023 and therefore did not have a previously recorded GPS location. This was found to be a successful way to record species on the areas of the island we visited, given the limited time and dense vegetation regrowth which made off-track walking difficult.

The collected specimens of introduced and native plants were identified where possible, photographed and pressed each day for subsequent submission to the Tasmanian Herbarium.

Photographs were also taken of as many species as possible for subsequent entry into FoTI's iNaturalist project (https://inaturalist.ala.org.au/projects/friends-of-tasman-island-foti).

Mark Wapstra (ECOtas) had alerted us to the presence of an exotic *Carex* species on Tasman Island that needed to be located. He referred us to Matthew

Baker (Curator, Weed Taxonomy at the Tasmanian Herbarium – HO) who had already *tentatively* identified it as *Carex hirta* from one specimen collected in 2007 by Penelope Tyson which was misidentified then as *Carex gaudichaudiana*. Matthew Baker supplied us with photographs and a description of this plant before we left Hobart.

Results

We collated all known plant collection records into two different spreadsheets, in which the names of plant families, genera and species were updated to follow those used in *A Census of the Vascular Plants of Tasmania, including Macquarie Island* (de Salas & Baker 2022). '(HO)' alongside the species name on both these spreadsheets indicates that a voucher specimen is held by the Tasmanian Herbarium (refer to Appendix 1).

For the purposes of this article we created Appendix 1, which summarises all the Tasman Island plant collection data into one spreadsheet. There are 146 dicotyledons, 157 monocotyledons, 11 ferns, two fungi, six lichens and two mosses recorded for the island. Only

Table 2. New species added to the Tasman Island Flora list by the authors at January 2023.

Family	Species name
a) **Introduced Plants**	
Monocotyledons	
Cyperaceae	*Carex hirta*
Iridaceae	*Gladiolus* x *colvillii*?
Dicotyledons	
Asteraceae	+ *Senecio minimus*
Asteraceae	*Senecio vulgaris*
Fabaceae	*Trifolium ornithopodioides*
Primulaceae	+ *Lysimachia (Anagallis) arvenis*
b) **Native Plants**	
Bryophytes	
Pottiaceae	*Weissia controversa* (Note: Found on all continents except Antarctica)
Monocotyledons	
Cyperaceae	*Isolepis platycarpa*
Juncaceae	*Juncus bufonius*
Poaceae	*Anthosachne (Elymus) scabra*
Poaceae	*Echinopogon ovatus*

Plate 2. Photographs of *Carex hirta* taken on Tasman Island by the authors, January 2023. Top: habitat; bottom left: distinctively hairy leaves; bottom right: inflorescences showing two to three male spikes above with two to three female spikes below.

those with '(HO)' or '(iNat/NVA)' after the species name have confirmed identifications and location data. We noted that to date no members of the Restionaceae family have been observed on Tasman Island.

The second spreadsheet was included as part of the comprehensive *Flora Report – Integrated Biological Survey of Tasman Island January 2023* (Carle & McEldowney 2023) submitted to FoTI. This spreadsheet collated all the individual collectors, their dates of collection, species and GPS readings, where available, as at January 2023. In this paper they are referred to as 'the Flora Report' and 'the Flora Spreadsheet'.

In January 2023 the authors were able to add 11 previously unrecorded species to the Tasman Island plant list (Table 2), nine of which were supported by a herbarium specimen and identified by Matthew Baker and/or members of HO staff. The other two (marked with a '+') were photographed and submitted to iNaturalist and their identification has since been confirmed.

This survey confirmed the presence of *Carex hirta* on Tasman Island (Plate 2). We were able to locate it on the first day of our trip, growing in the same area where Penelope Tyson collected the specimen in 2007. This was south of the derelict relief keepers' cottage and north of Q1, but subsequently we found plants on both sides of the track running north–south between the haulage and Q1. We noted that it

was widespread across a 50 m × 50 m area, but suspect it occupies a larger area than that. On our return to Hobart, we submitted fresh *Carex hirta* material to HO, and its identity was confirmed by Matthew Baker.

Our observations were also posted on the FoTI iNaturalist project:

https://inaturalist.ala.org.au/observations/149227447 and https://inaturalist.ala.org.au/observations/149036035

Discussion

Carex hirta is a perennial native of Europe and has never been recorded as growing anywhere in Australia before. Although it was collected in New Zealand in 1942, it was not correctly identified there until 2000 (Museum of New Zealand Te Papa Tongarewa 2023). Its preferred habitat is described as rough grassy places, damp meadows etc. (Clapham et al. 1968).

Matthew Baker at the Tasmanian Herbarium has reported the finding of *Carex hirta* on Tasman Island to the Ranger in Charge at Tasman National Park, and also to Biosecurity at NRE Tasmania. A formal survey will be undertaken on the full extent of this *Carex* species on the island. Its potential to spread has recently been assessed as relatively low risk (M. Noble & M. Baker, pers. comm. Sept. 2023); nonetheless, biosecurity awareness protocols are being developed for visitors exiting Tasman Island.

It is suspected that *Carex hirta* has been on the island for many years, probably from the time when the lighthouse was manned. The sedge was located on the low-lying damp land adjacent to the relief keepers' cottage, where it had formed a dense mat of rhizomes which were found to be difficult to dig up.

Ornithologist Els Wakefield, who was also on the island as part of this integrated survey, reported her observation that the *Carex hirta* tussocks had become habitat for the shy Lewin's Rail (*Rallus pectoralis*), which hides amongst sedge and reed beds. However, she also commented that there is currently plenty of alternative habitat on Tasman Island if the decision is made to remove this introduced plant; she did not think that it would be an issue for the bird.

As previously discussed in the History section, the Tasman Island vegetation has changed significantly. This was observed on tracks to the west of the island where introduced grasses and sedges, in particular *Carex appressa*, have grown tall and shrubby vegetation is in the process of closing in on previously open areas. This growth appears to be crowding out many of the smaller native herbs which may eventually be lost due to the competition and lack of light. In drought years, despite the mowing undertaken around the buildings by FoTI volunteers, this vegetation is more susceptible to fire and this could threaten the heritage-listed buildings.

Appendix 1 shows that the FoTI weeding working bees have been successful. By January 2023 eradication of the majority of introduced weeds and garden plants appeared to have been achieved. For

example, *Sedum praelatum*, *Aeonium arboretum*, *A. haworthii*, *Pelargonium* × *domesticum*, arum lilies, narcissus and grape hyacinths have not been collected since 2007/2008. The main exceptions are scarlet gladiolus (*Gladiolus* × *colvillii*?), montbretia (*Crocosmia* × *crocosmiiflora*) and wild radish (*Brassica rapa*), which were found in January 2023, but these species will need to be located and removed during future working bees.

Many weeds were introduced to Tasman Island via animal feed and pasture grasses. The most persistent and difficult to eradicate, and hence a continuing target of the FoTI weed working bees, is the Californian thistle (*Cirsium arvense*).

There are two plants of *Myoporum insulare* growing to the south-west of Q1. It is believed that in 1969 these were planted out from pots by Ann Landers, the wife of the then lighthouse keeper. These two plants continue to grow where they were planted out and are now 3–4 m high, but show no sign of spreading elsewhere. FoTI made the decision not to remove these plants because of their historical connections (E. Shankley, FoTI Archives).

Schahinger (2002a) noted a number of species known to grow on nearby Cape Pillar appeared to be absent from Tasman Island; his list included *Bedfordia salicina,* but we were able to reconfirm Penelope Tyson's 2008 observation when we saw three plants growing in the north-west corner of the island.

Schahinger (2002a) noted the absence of *Epacris marginata* on Tasman Island, despite the fact that a specimen had been collected for HO by R. A. Burns in November 1987 (see Appendix 1 and the Flora Spreadsheet). It would be of interest if it is still growing at its recorded location, but as at January 2023 there have been no further sightings or collections of this species on Tasman Island.

Appendix 1 and the Flora Spreadsheet list three *Leptecophylla* species which had been originally named as *L. abietina?, L. juniperina* and *L. oxycedrus.*

Following changes in *Leptecophylla* nomenclature by Jarman and Kantvilas (2017), the *Leptecophylla* species commonly found on Tasman Island has since been identified as *L. oxycedrus.*

L. juniperina is now considered to be a New Zealand–only species. However, HSMISP (2005) collected one specimen which they identified as *L. juniperina*, but it was not collected as a herbarium specimen or with location data. This identification therefore cannot be confirmed and we have expressed this observation in Appendix 1 and in the Flora Spreadsheet as *Leptecophylla juniperina* (*L. oxycedrus?*).

L. abietina? was an unconfirmed 1982 identification by Harris and Brothers and used in the HSMISP 2005 report. It is possible that *L abietina* also exists on Tasman Island as it has been found on nearby rocky coasts (ALA 1991; Crowden & Duretto 2019), and future surveys may identify it. Although *L. abietina* and *L. oxycedrus* both have leaves greater than 7 mm long, the insides of the flowers of *L. abietina* are densely hairy compared to those of

L. oxycedrus, which are glabrous or have just a few hairs.

Because of the summer timing of this field trip, many species such as the orchids (*Thelymitra* spp. and *Microtis* spp.) and weedy garden species that flower in spring or early summer were not sighted.

In Appendix 1 and the Flora Spreadsheet we updated nomenclature used by previous surveys to reflect changes in taxonomy. These changes, plus other interesting observations and future areas of study, are listed below:

- As *Rubus gunnianus* (listed in HSMISP 2005) is a subalpine/alpine species found growing above 900 m, we believe this was a misidentification and it is likely to have been the juvenile leaves of *Apium prostratum* var. *filiforme*.

- *Correa reflexa* var. *nummulariifolia* was identified as growing on Tasman Island by Harris and Brothers (1982), but the only *Correa* species we found in January 2023 was *C. alba* var. *rotundifolia*. Future surveys should look to see if *C. reflexa* and its subspecies occur on Tasman Island.

- *Hydrocotyle hirta* was locally common on the island, often with leaves in excess of 90 mm diameter, and could be observed scrambling above the ground vegetation, unlike its usual habit of small leaves 6–25 mm in diameter and scrambling under the other ground vegetation. See also https://inaturalist.ala.org.au/observations/149117986 . We note VicFlora 2023 states: "A variable species in need of detailed study to determine if any of the leaf forms require formal recognition".

- We were unable to confirm Penelope Tyson's three 2007 Tasman Island NVA records of the hybrid *Pittosporum bicolor* × *undulatum*. We saw an abundance of *Pittosporum bicolor* in full fruit (https://inaturalist.ala.org.au/observations/149123750) and a number of what we thought were juvenile hybrid plants, but found no evidence of adult plants of the weedy *Pittosporum undulatum*. We would normally expect to find both parent plants present (M. Baker pers. comm. April 2023) and it should be confirmed if a) the two *Pittosporum bicolor* × *undulatum* plants recorded on the NVA are still present, and b) if adult plants of *P. undulatum* can be located and surveyed during future FoTI working bees.

- Photographs of an introduced *Cerastium* species (mouse-ear chickweed) thought to be *C. vulgare* were taken adjacent to the old oil store near the lighthouse and posted on the iNaturalist FoTI project page (https://inaturalist.ala.org.au/observations/148962851). There are two existing records of *Cerastium vulgare* for Tasman Island by Harris and Brothers in 1982 (cited in HSMISP 2005) and by Mark Wapstra in 2018, who reported it was locally frequent. Questions have been raised whether or not this plant is perennial.

- As at 26 January 2023 (NVA 2023) no lichens, bryophytes or fungi had been recorded on Tasman Island. However, during the January field trip we observed two fungi species, namely

an old *Bovista brunnea* (true puffball) and an old *Omphalotus nidiformis* (ghost fungus) growing on *Allocasuarina*. This is not surprising given we were there in summer and the windswept environment of Tasman Island further adds to the dry conditions, which are not conducive to the growth of fungi. The absence on Tasman Island of *Eucalyptus* species, one of the main ectomycorrhizal host plant genera, also limits the number of ectomycorrhizal fungi. However, there are species of *Allocasuarina*, *Acacia*, *Leptospermum*, *Calytrix* and *Melaleuca* on the island, which are all known to have ectomycorrhizal associations (Brundrett 2008) and wood-decomposing species (saprotrophs) are likely to be found when conditions are more favourable for production of fungal fruitbodies.

We observed and posted onto FoTI's iNaturalist project a number of lichens and mosses (see Appendix 1 and the Flora Spreadsheet). These have not been identified with any certainty, except for one moss, *Weissia controversa*, which was collected and subsequently identified by HO. This species is found on all continents except Antarctica.

More work is needed on the lichens and bryophytes of Tasman Island and would support the following comments in 'Overview of Tasmania's offshore islands and their role in nature conservation' (Bryant & Harris 2021, p. 83):

> … many islands remain data-poor especially for invertebrate fauna, and non-vascular flora, and information sources are dispersed across numerous platforms. While more than 90% of Tasmania's offshore islands are statutory reserves, many are impacted by a range of disturbances, particularly invasive species with no decision-making framework in place to prioritise their management. …

It is anticipated that all these questions will be followed up during future working bees.

The future of Tasman Island flora

There are still many opportunities for botanists to record Tasman Island flora, in particular during early-season surveys which may uncover new small native or introduced plants, lichens and bryophytes. Of particular interest are the dry and rocky cliff tops towards the east, southeast and southwest that are accessible only to fit and able botanists who will be able to safely climb some of the cliffs and get down close to the sea level.

We recommend that either herbarium specimens of **all** the native and introduced species (including any weedy garden species) on the island which have not been recently recorded on the NVA should be collected and submitted to the Tasmanian Herbarium for their subsequent inclusion on the NVA (this is the preferred option, but for which a Plant Collecting Permit is required) or that they are photographed and placed on FoTI's iNaturalist Project and, provided these observations reach research grade, that they will then be included in the NVA project set up to harvest the Tasmanian research grade observations from the Atlas of Living

Australia (ALA).

It has also been arranged with FoTI for the Flora Spreadsheet to be updated as changes are confirmed.

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Penelope and Robert Tyson for their significant contribution to the Tasman Island plant records.

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Appendix 1. List of all plant species found on Tasman Island as at 31 January 2023 (together with a GPS location where known) and a record of dates sighted.

Notes:

(HO) = Plant specimen held by Tasmanian Herbarium

(HO but only with TI location) = 1977 Nigel Brothers collected HO specimens, but only recorded Tasman Island (TI) as the location

2005 = Hamish Saunders Memorial Trust Survey, did not collect herbarium specimens and only recorded Tasman Island as the location

(iNat/NVA) = confirmed iNaturalist observation which will appear on the Tasmanian Natural Values Atlas (NVA)

Longitude/latitude readings = taken from a single location only for reference purposes here. Where more than one 'date sighted' is noted, other GPS readings, except for 2005, will be available.

Status column: i = introduced Tasmanian species; e = endemic Tasmanian species; no symbol = species is native to Tasmania and the mainland.

++ On Tasman Island *Allocasuarina crassa* is the only species listed as Rare on the schedules of the Tasmanian *Threatenend Species Protection Act 1995*.

Dicotyledons						
Family	**Species name**	**Preferred common name**	**Status**	**Longitude**	**Latitude**	**Dates sighted**
Aizoaceae	*Carpobrotus rossii* (HO)	native pigface		148.00461	-43.23859	2005, 2007, 2023
Aizoaceae	*Tetragonia implexicoma* (HO)	bower spinach		148.00430	-43.23861	2005, 2007
Amaranthaceae	*Einadia nutans* subsp. *nutans* (HO)	climbing saltbush		147.99977	-43.23936	2005, 2007
Amaranthaceae	*Rhagodia candolleana* subsp. *candolleana* (HO)	coast saltbush		148.00310	-43.23343	2005, 2007, 2023
Amaranthaceae	*Salicornia quinqueflora* subsp. *quinqueflora* (HO)	beaded glasswort		147.99938	-43.23274	2005, 2007, 2023
Amaranthaceae	*Suaeda australis* (HO)	southern seablite		148.00662	-43.24068	2005, 2008

Apiaceae	*Apium prostratum* var. *filiforme* (HO)	slender sea-celery		148.00483	-43.24122	2005, 2007, 2023
Apiaceae	*Hydrocotyle hirta* (HO)	hairy pennywort		148.00456	-43.23961	2005, 2007, 2023
Asteraceae	*Achillea millefolium* (HO)	yarrow	i	148.00213	-43.23900	2004, 2005, 2007, 2008
Asteraceae	*Actites megalocarpus* (HO)	dune thistle		148.00563	-43.23293	2007
Asteraceae	*Bedfordia salicina* (HO)	Tasmanian blanketleaf		148.00068	-43.23483	2008, 2023
Asteraceae	*Brachyscome aculeata* (HO)	hill daisy		148.00208	-43.24085	2007
Asteraceae	*Brachyscome spathulata glabra*	blue daisy				2005
Asteraceae	*Cassinia aculeata*	dollybush				2005
Asteraceae	*Cirsium arvense var. arvense* (HO)	Californian thistle	i	148.00265	-43.23685	2005, 2007, 2008, 2023
Asteraceae	*Cirsium vulgare* (iNat/NVA)	spear thistle	i	148.00296	-43.23686	2005, 2023
Asteraceae	*Coronidium scorpioides* (HO)	curling everlasting		148.00314	-43.24199	2007, 2023
Asteraceae	*Cotula australis* (HO)	southern buttons		147.99948	-43.23822	2007
Asteraceae	*Crepis capillaris* (HO)	smooth hawksbeard	i	148.00310	-43.23343	2007
Asteraceae	*Euchiton litticola* (HO)	coast cottonleaf	e	148.00031	-43.24233	2005, 2008
Asteraceae	*Helichrysum luteoalbum* (HO)	Jersey cudweed		148.00633	-43.23275	2005, 2007
Asteraceae	*Hypochaeris glabra* (HO)	smooth catsear	i	147.99824	-43.23978	2005, 2007
Asteraceae	*Hypochaeris radicata* (HO)	rough catsear	i	148.00546	-43.24044	2005, 2009, 2023
Asteraceae	*Leontodon saxatilis*	hairy hawkbit	i			2005
Asteraceae	*Leptinella longipes*	coast buttons				2005
Asteraceae	*Leptinella reptans*	creeping buttons				2005

Asteraceae	*Olearia phlogopappa* subsp. *phlogopappa* (HO)	coast dusty daisybush		148.00312	-43.24169	1977, 2008, 2023
Asteraceae	*Olearia ramulosa* (HO)	twiggy daisybush		148.00592	-43.23269	2005, 2007, 2023
Asteraceae	*Olearia stellulata*	sawleaf daisybush				2005
Asteraceae	*Ozothamnus ferrugineus* (HO)	tree everlastingbush		148.00310	-43.23343	1993, 2007, 2023
Asteraceae	*Ozothamnus reflexus* (HO)	columnar everlastingbush		148.00456	-43.23961	2005, 2007, 2018, 2023
Asteraceae	*Ozothamnus reticulatus*	veined everlastingbush				2005
Asteraceae	*Picris angustifolia* subsp. *angustifolia* (HO)	lowland hawkweed	i	148.00066	-43.23357	2007, 2018, 2023
Asteraceae	*Senecio angulatus* (HO)	scrambling groundsel	i	148.00374	-43.24093	2007
Asteraceae	*Senecio biserratus* (HO)	jagged fireweed		148.00537	-43.23691	2005, 2007
Asteraceae	*Senecio glomeratus* subsp. *longifructus* (HO)	longfruit purple fireweed		148.00148	-43.23845	2008
Asteraceae	*Senecio linearifolius* var. *denticulatus* (HO)	toothed fireweed groundsel		148.00675	-43.23828	2008
Asteraceae	*Senecio linearifolius* var. *linearifolius* (HO)	common fireweed groundsel		148.00415	-43.23886	2008
Asteraceae	*Senecio minimus* (iNat/NVA)	coastal burnweed		148.00212	-43.23917	2023
Asteraceae	*Senecio pinnatifolius* var. *lanceolatus* (HO)	lanceleaf coast groundsel		147.99959	-43.23812	2005, 2007, 2023(?)
Asteraceae	*Senecio vulgaris* (HO)	common groundsel	i	148.00318	-43.23662	2023
Asteraceae	*Sonchus asper* (HO)	prickly sowthistle	i	147.99931	-43.23523	2005, 2007, 2008
Asteraceae	*Sonchus oleraceus* (HO)	common sowthistle	i	148.00412	-43.23459	2007
Asteraceae	*Taraxacum officinale* (HO)	common dandelion	i	148.00169	-43.23550	2005, 2007
Asteraceae	*Vellereophyton dealbatum* (HO)	white cudweed	i	147.99983	-43.24199	2005, 2007, 2023

Asteraceae	*Xerochrysum papillosum* (HO)	cliff paperdaisy		148.00264	-43.24105	2005, 2007, 2008, 2023
Brassicaceae	*Brassica rapa* (HO)	turnip	i	148.00387	-43.23980	2007
Brassicaceae	*Lepidium didymum* (HO)	lesser swinecress	i	148.00148	-43.23845	2008
Brassicaceae	*Lepidium foliosum* (HO)	leafy peppercress		147.99987	-43.23471	2005, 2007, 2008
Brassicaceae	*Lepidium pseudotasmanicum* (HO)	shade peppercress		148.00150	-43.23265	2008, 2018
Brassicaceae	*Raphanus raphanistrum* (HO)	wild radish	i	148.00522	-43.23814	2007, 2023
Campanulaceae	*Lobelia anceps* (HO)	angled lobelia		148.00369	-43.24245	2008
Campanulaceae	*Wahlenbergia gracilis* (HO)	sprawling bluebell		148.00631	-43.23418	2005, 2007
Brassicaceae	*Brassica rapa* (HO)	turnip	i	148.00387	-43.23980	2007
Caryophyllaceae	*Cerastium vulgare* (HO)	mouse-ear chickweed	i	148.0049	-43.23974	2005, 2018, 2023
Caryophyllaceae	*Colobanthus apetalus* var. *apetalus* (HO)	coast cupflower		147.99983	-43.24199	2005, 2007
Caryophyllaceae	*Sagina procumbens* (HO)	spreading pearlwort	i	148.00000	-43.23333	2008, 2023
Caryophyllaceae	*Scleranthus biflorus* (HO)	twinflower knawel		148.00310	-43.23343	2005, 2007, 2023
Caryophyllaceae	*Stellaria media* (HO)	garden chickweed	i	148.00369	-43.24109	2007
Caryophyllaceae	*Stellaria multiflora* subsp. *multiflora* (HO)	rayless starwort		147.99974	-43.23959	2007
Casuarinaceae	*Allocasuarina crassa* (HO) ++	cape pillar sheoak	e	148.00269	-43.23786	1965, 1990, 2007, 2014, 2023
Casuarinaceae	*Allocasuarina verticillata* (HO)	drooping sheoak		148.00076	-43.23965	2005, 2007, 2023
Celastraceae	*Stackhousia monogyna* (HO)	forest candles		148.00086	-43.24042	2005, 2007, 2023
Celastraceae	*Stackhousia spathulata* (HO)	coast candles		147.99989	-43.24193	2005, 2023
Convolvulaceae	*Dichondra repens*	kidneyweed				2005

Crassulaceae	*Aeonium arboreum* (HO)	tree aeonium	i	148.00394	-43.24087	2007, 2008
Crassulaceae	*Aeonium haworthii* (HO)	pinwheel	i	148.00394	-43.24087	2007
Crassulaceae	*Crassula sieberiana* (HO)	sieber crassula		148.00525	-43.23949	2005, 2023
Crassulaceae	*Crassula tetramera* (HO)	wiry stonecrop		148.00309	-43.23352	2007
Crassulaceae	*Sedum praealtum* (HO)	green cockscomb	i	148.00394	-43.24087	2007
Ericaceae	*Cyathodes glauca* (HO)	purple cheeseberry		148.00000	-43.23330	1987
Ericaceae	*Epacris marginata* (HO)	rigid heath		148.00000	-43.23330	1987
Ericaceae	*Leptecophylla abietina?*	seaspray pinkberry	e			2005
Ericaceae	*Leptecophylla juniperina (L. oxycedrus?)*	pinkberry				2005
Ericaceae	*Leptecophylla oxycedrus* (HO)	coast pinkberry		148.00445	-43.23827	2007, 2008, 2023
Ericaceae	*Leucopogon parviflorus* (HO)	coast beardheath		148.00456	-43.23961	2005, 2007, 2023
Ericaceae	*Monotoca glauca* (HO)	goldey wood		148.00430	-43.23861	2005, 2007, 2023
Euphorbiaceae	*Euphorbia peplus* (HO)	petty spurge	i	148.00496	-43.23916	2007, 2023
Fabaceae	*Acacia melanoxylon* (HO)	blackwood		148.00715	-43.23537	2005, 2007
Fabaceae	*Acacia verticillata* subsp. *ruscifolia* (HO)	broadleaf prickly moses		148.00233	-43.23470	1977, 2005, 2007, 2023
Fabaceae	*Acacia verticillata* subsp. *verticillata* (HO)	prickly moses		148.00148	-43.23853	2005, 2007
Fabaceae	*Glycine clandestina*	twining glycine				2005
Fabaceae	*Kennedia prostrata* (HO)	running postman		148.00129	-43.23527	1977, 2007, 2023
Fabaceae	*Medicago polymorpha* (HO)	burr medic	i	148.00175	-43.23509	2007
Fabaceae	*Pultenaea daphnoides* (HO)	heartleaf bushpea		148.00221	-43.24128	1977, 2005, 2007
Fabaceae	*Pultenaea dentata* (HO)	swamp bushpea		147.99987	-43.24031	1977, 2005, 2007

Fabaceae	*Trifolium cernuum* (HO)	nodding clover	i	147.99824	-43.23978	2007
Fabaceae	*Trifolium dubium* (HO)	suckling clover	i	148.00003	-43.24053	2007, 2023
Fabaceae	*Trifolium glomeratum* (HO but only with 'TI' location)	cluster clover	i			1977
Fabaceae	*Trifolium repens* (HO)	white clover	i	148.00352	-43.24100	2007
Fabaceae	*Trifolium subterraneum* (HO)	subterranean clover	i	148.00369	-43.24109	2005, 2007
Fabaceae	*Vicia hirsuta* (HO)	hairy vetch	i	148.00705	-43.23665	2007, 2018, 2023
Fabaceae	*Vicia sativa* subsp. *nigra* (HO)	narrowleaf vetch	i	148.00087	-43.24043	1977, 2005, 2007, 2023
Fumariaceae	*Fumaria muralis* subsp. *muralis* (HO)	wall fumitory	i	148.00387	-43.23980	2007
Geraniaceae	*Erodium cicutarium* (HO)	common heronsbill	i	147.99813	-43.23988	2007
Geraniaceae	*Erodium cicutarium* (HO)	common heronsbill	i	147.99948	-43.23822	2007
Geraniaceae	*Erodium moschatum* (HO)	musk stork's-bill	i	147.99959	-43.23800	2007
Geraniaceae	*Geranium potentilloides var. potentilloides* (HO)	mountain cranesbill		148.00309	-43.23352	2005, 2007
Geraniaceae	*Pelargonium australe* (HO)	southern storksbill		147.99978	-43.23659	1977, 2007, 2023
Geraniaceae	*Pelargonium* x *domesticum* (HO)	garden geranium	i	148.00000	-43.23333	2006, 2007
Haloragaceae	*Gonocarpus teucrioides* (HO)	forest raspwort		148.00461	-43.23953	2005, 2007, 2023
Myrtaceae	*Calytrix tetragona* (HO)	common fringemyrtle		147.99972	-43.23556	2005, 2007, 2023
Myrtaceae	*Leptospermum glaucescens* (HO)	smoky teatree		148.00304	-43.23384	2005, 2007, 2023
Myrtaceae	*Leptospermum lanigerum*	woolly teatree				2005
Myrtaceae	*Leptospermum scoparium* (HO)	common teatree		148.00074	-43.24044	1977, 2007, 2023
Myrtaceae	*Melaleuca squarrosa* (HO)	scented paperbark		148.00323	-43.23642	1977, 2007, 2023

Onagraceae	*Epilobium billardiereanum* subsp. *cinereum* (HO)	willowherb	i	148.00434	-43.23808	2008, 2023
Oxalidaceae	*Oxalis articulata* (HO)	bent woodsorrel	i	148.00154	-43.23852	2008
Oxalidaceae	*Oxalis perennans* (HO)	grassland woodsorrel	i	147.99944	-43.23944	2007, 2023
Phyllanthaceae	*Poranthera microphylla* (HO)	small poranthera		148.00031	-43.24110	2005, 2023
Pittosporaceae	*Billardiera longiflora* (HO)	purple appleberry		148.00514	-43.23899	2005, 2009
Pittosporaceae	*Billardiera ovalis* (HO)	seaspray appleberry		148.00722	-43.23706	2007, 2023
Pittosporaceae	*Bursaria spinosa* subsp. *spinosa* (HO)	prickly box		148.00408	-43.23405	2005, 2007, 2023
Pittosporaceae	*Pittosporum bicolor* (HO)	cheesewood		148.00150	-43.23999	1993, 2005, 2007, 2023
Pittosporaceae	*Pittosporum bicolor* x *undulatum* (HO)	hybrid pittosporum	i	148.00181	-43.24063	2007, 2023?
Plantaginaceae	*Plantago coronopus* subsp. *coronopus* (HO)	slender buckshorn plantain	i	148.00638	-43.23295	2005, 2007
Plantaginaceae	*Plantago hispida* (HO)	hairy plantain		148.00109	-43.23403	2007, 2023
Plantaginaceae	*Plantago lanceolata* (HO)	ribwort plantain	i	148.00389	-43.24118	2007
Plantaginaceae	*Plantago major*	great plantain	i			2005
Plantaginaceae	*Plantago triantha* (HO)	saltspray plantain		148.00303	-43.24210	2005, 2007, 2008
Plantaginaceae	*Plantago varia* (HO)	variable plantain	i	147.99966	-43.23986	2007
Plantaginaceae	*Veronica elliptica* (HO)	kokomuka	i	148.00283	-43.23679	2006, 2007, 2008
Plantaginaceae	*Veronica gracilis* (HO)	slender speedwell		148.00723	-43.23834	2007, 2008
Polygalaceae	*Comesperma volubile* (HO)	blue lovecreeper		148.00195	-43.24126	2005, 2007
Polygonaceae	*Acetosella vulgaris* (HO)	sheep sorrel	i	148.00304	-43.23384	2005, 2007, 2023

Polygonaceae	*Rumex brownii* (HO)	slender dock	i	147.99959	-43.23680	2008, 2023
Polygonaceae	*Rumex crispus* (HO)	curled dock	i	148.00000	-43.23333	2008
Portulacaceae	*Calandrinia calyptrata* (HO)	pink purslane		147.99948	-43.23822	2007, 2008
Primulaceae	*Lysimachia arvensis* (*Anagallis arvensis)* (iNat/NVA)	scarlet pimpernel	i	148.00499	-43.23927	2023
Proteaceae	*Banksia marginata* (HO)	silver banksia		148.00304	-43.23384	2005, 2007, 2023
Rosaceae	*Acaena novae-zelandiae* (HO)	common buzzy		148.00310	-43.23343	1977, 2007, 2023
Rosaceae	*Rubus leucostachys* (HO)	blackberry	i	148.00274	-43.23683	2007
Rubiaceae	*Coprosma repens*	mirrorbush	i			2005
Rubiaceae	*Galium australe* (HO)	coast bedstraw		148.00148	-43.23255	2007, 2018, 2023
Rubiaceae	*Opercularia varia* (HO)	variable stinkweed		148.00002	-43.24146	2007, 2023
Rutaceae	*Correa alba* var. *rotundifolia* (HO)	rusty white correa		148.00077	-43.24043	1993, 2007, 2023
Rutaceae	*Correa reflexa* var. *nummulariifolia*	roundleaf correa	e			2005
Santalaceae	*Exocarpos cupressiformis*	common native-cherry				2005
Santalaceae	*Exocarpos strictus* (HO)	pearly native-cherry		148.00221	-43.24128	2007, 2023
Sapindaceae	*Dodonaea viscosa* subsp. *spathulata*	sticky hop-bush				2005
Scrophulariaceae	*Myoporum insulare* (HO)	common boobialla	i	148.00262	-43.23723	2005, 2007, 2023
Stylidiaceae	*Stylidium armeria* subsp. *armeria* (HO)	broadleaf triggerplant		147.99987	-43.24035	1977, 2007, 2023
Stylidiaceae	*Stylidium graminifolium*	narrowleaf triggerplant				2005
Solanaceae	*Solanum laciniatum* (HO)	kangaroo apple		148.00135	-43.23849	2005, 2008
Solanaceae	*Solanum vescum* (HO)	gunyang		148.00096	-43.23886	2007

Urticaceae	*Australina pusilla* subsp. *pusilla* (HO)	small shade nettle		148.00309	-43.24012	2007, 2023
Violaceae	*Viola hederacea hederacea* (HO)	ivyleaf violet		148.00473	-43.23832	1977, 2005, 2007, 2023
Winteraceae	*Tasmannia lanceolata* (HO)	mountain pepper		148.00727	-43.23761	1977, 2005, 2007, 2023
Monocotyledons						
Family	**Species name**	**Preferred common name**	**Status**	**Longitude**	**Latitude**	**Dates sighted**
Amaryllidaceae	*Narcissus pseudonarcissus* (HO)	wild daffodil	i	148.00580	-43.23810	2007
Amaryllidaceae	*Narcissus tazetta* (HO)	tazetta	i	148.00238	-43.23933	2007
Araceae	*Zantedeschia aethiopica* (HO)	arum lily	i	148.00396	-43.23996	2004, 2008
Asparagaceae	*Muscari armeniacum* (HO)	grape hyacinth	i	148.00394	-43.24087	2007
Asphodelaceae	*Bulbine semibarbata* (HO)	smallflower leeklily		148.00489	-43.23315	2005, 2007
Cyperaceae	*Carex appressa* (HO)	tall sedge		148.00398	-43.23957	1977, 2005, 2007, 2023
Cyperaceae	*Carex breviculmis* (HO)	shortstem sedge		148.00391	-43.23327	2007
Cyperaceae	*Carex hirta* (HO)	hairy sedge	i	148.00242	-43.23590	2009, 2023
Cyperaceae	*Ficinia nodosa* (HO)	knobby clubsedge		148.00507	-43.24001	2005, 2007, 2023
Cyperaceae	*Gahnia grandis*	cutting grass				2005
Cyperaceae	*Isolepis cernua* (HO)	nodding clubsedge		148.00369	-43.24245	2008
Cyperaceae	*Isolepis inundata* (HO)	swamp clubsedge		148.00515	-43.23531	2005, 2007, 2009
Cyperaceae	*Isolepis platycarpa* (HO)	nodding clubsedge		148.00050	-43.24040	2023
Cyperaceae	*Lepidosperma elatius*	tall swordsedge				2005

Cyperaceae	*Lepidosperma gladiatum* (HO)	coast swordsedge		148.00066	-43.23278	2007
Hemerocallidaceae	*Dianella brevicaulis* (HO)	shortstem flaxlily		148.00584	-43.23299	2007, 2023
Hemerocallidaceae	*Dianella revoluta*	spreading flaxlily				2005
Hemerocallidaceae	*Dianella tasmanica* (HO)	Tasmanian flaxlily		148.00378	-43.23710	1977, 2023
Iridaceae	*Crocosmia* x *crocosmiiflora* (HO)	montbretia	i	148.00530	-43.23971	2008, 2023
Iridaceae	*Gladiolus* x *colvillii ?* (HO)	scarlet gladiolus	i	148.00404	-43.23701	2023
Juncaceae	*Juncus bufonius* (HO)	toadrush		148.00269	-43.23600	2023
Juncaceae	*Juncus pallidus* (HO)	pale rush		148.00398	-43.23957	2005, 2007
Juncaceae	*Luzula densiflora* (HO but only with 'TI' location)	dense woodrush				1977
Juncaceae	*Luzula flaccida* (HO)	pale woodrush		148.00145	-43.23511	2007
Luzuriagaceae	*Drymophila cyanocarpa* (HO)	turquoise berry		148.00149	-43.23871	2005, 2007
Orchidaceae	*Microtis arenaria* (HO)	notched onion-orchid		148.00124	-43.23431	2012
Orchidaceae	*Microtis unifolia*	common onion-orchid				2005
Orchidaceae	*Pterostylis decurva* (HO)	summer greenhood		148.00122	-43.23436	2007
Orchidaceae	*Pterostylis melagramma* (HO)	blackstripe greenhood		148.00198	-43.24108	2007
Orchidaceae	*Pterostylis pedunculata* (HO)	maroonhood		148.00700	-43.23822	2007
Orchidaceae	*Thelymitra aristata*	great sun-orchid				2005
Orchidaceae	*Thelymitra ixioides*	spotted sun-orchid				2005
Orchidaceae	*Thelymitra pauciflora*	slender sun-orchid				2005
Orchidaceae	*Thelymitra* sp. (HO)	sun-orchid		148.00285	-43.24331	2008

Poaceae	*Agrostis capillaris* (HO)	bentgrass	i	148.00261	-43.24060	2008
Poaceae	*Agrostis gigantea* (HO)	black bent	i	148.00125	-43.23767	2008
Poaceae	*Aira caryophyllea* subsp. *caryophyllea*	silvery hairgrass	i			2005
Poaceae	*Aira elegantissima*	delicate hairgrass	i			2005
Poaceae	*Aira praecox* (HO)	early hairgrass	i	148.00519	-43.23998	2008, 2023
Poaceae	*Anthosachne scabra* (HO)	common wheatgrass		148.00367	-43.23318	2023
Poaceae	*Anthoxanthum odoratum* (HO)	sweet vernalgrass	i	148.00344	-43.23863	2007, 2018
Poaceae	*Austrostipa stipoides*	coast speargrass				2005
Poaceae	*Bromus diandrus* (HO)	great brome	i	147.99813	-43.23988	2007
Poaceae	*Cynosurus echinatus* (HO)	rough dogstail	i	148.00235	-43.23356	2005, 2008, 2012, 2023
Poaceae	*Dactylis glomerata* (HO)	cocksfoot	i	148.00385	-43.24087	2005, 2007
Poaceae	*Dichelachne crinita* (HO)	longhair plumegrass		148.00718	-43.23510	2005, 2007, 2008, 2023
Poaceae	*Echinopogon ovatus* (HO)	forest hedghog grass		148.00250	-43.23583	2023
Poaceae	*Elytrigia repens* (HO)	English couch	i	148.00133	-43.23852	2008, 2023
Poaceae	*Hierochloe redolens* (HO)	sweet holygrass	i	148.00393	-43.23690	2005, 2007, 2023
Poaceae	*Holcus lanatus* (HO)	Yorkshire fog	i	148.00415	-43.23886	1977, 2008
Poaceae	*Hordeum leporinum* (HO)	long-anther barleygrass	i	147.99975	-43.23304	2005, 2007
Poaceae	*Lolium perenne*	perennial ryegrass	i			2005, 2023 (sighted)
Poaceae	*Poa poiformis* var. *poiformis* (HO)	coast tussockgrass		148.00058	-43.24385	1977, 2005, 2007, 2008

Poaceae	*Poa poiformis* var. *ramifer* (HO)	island purplegrass		148.00492	-43.23979	2005, 2007, 2008
Poaceae	*Rytidosperma caespitosum* (HO)	common wallabygrass		148.00399	-43.23307	2007, 2023
Poaceae	*Rytidosperma pilosum*	velvet wallabygrass				2005
Poaceae	*Vulpia bromoides* (HO)	squirreltail fescue	i	148.00058	-43.24385	2008
Poaceae	*Vulpia myuros* f. *myuros* (HO)	ratstail fescue	i	148.00421	-43.24165	2004, 2008
Ferns – Pteridophytes						
Family	**Species name**	**Preferred common name**	**Status**	**Longitude**	**Latitude**	**Dates sighted**
Adiantaceae	*Cheilanthes austrotenuifolia*	green rockfern				2005
Aspleniaceae	*Asplenium decurrens* (HO)	shore spleenwort		148.00325	-43.23871	2005, 2007, 2023
Blechnaceae	*Blechnum wattsii* (HO)	hard waterfern		148.00314	-43.24199	2005, 2007, 2023
Dennstaedtiaceae	*Pteridium esculentum* subsp. *esculentum* (HO)	bracken		148.00455	-43.23910	2005, 2007, 2023
Dicksoniaceae	*Dicksonia antarctica* (HO)	soft treefern		148.00312	-43.24169	2005, 2007, 2023
Dryopteridaceae	*Polystichum proliferum* (HO)	mother shieldfern		148.00254	-43.24015	2005, 2007, 2023
Dryopteridaceae	*Rumohra adiantiformis* (HO)	leathery shieldfern		148.00149	-43.23871	2007
Grammitidaceae	*Notogrammitis angustifolia* subsp. *nothofageti*	beech fingerfern				2005
Lycopodiaceae	*Phlegmariurus varius* (HO)	long clubmoss		148.00534	-43.23997	2005, 2007
Lycopodiaceae	*Lycopodiella lateralis*	slender clubmoss				2005
Polypodiaceae	*Microsorum pustulatum* subsp. *pustulatum* (HO)	kangaroo fern		148.00181	-43.24018	2005, 2007, 2023

Fungi /Lichenised fungi						
Family	**Species name**	**Preferred common name**	**Status**	**Longitude**	**Latitude**	**Dates sighted**
Agaricaceae	*Bovista brunnea*	true puff-ball		148.00596	-43.23378	2023
Marasmiaceae	*Omphalotus nidiformis* (iNat/NVA)	ghost fungi		148.00664	-43.23868	2023
Cladoniaceae	*Cladonia* sp.*?*	fruticose lichen		148.00192	-43.23469	2023
Parmeliaceae	*Usnea* sp.	beard lichen		148.00463	-43.23849	2023
Parmeliaceae	*Xanthoparmelia* sp.*?*	rock-shield lichen		148.00518	-43.23940	2023
Peltigeraceae	*Pseudocyphellaria* sp.*?*	specklebelly lichens		148.00500	-43.23917	2023
Ramalinaceae	*Ramalina fastigiata?*	dotted ribbon lichen		148.00167	-43.23926	2023
Teloschistaceae	*Teloschistes chrysophthalmus?*	golden-eye lichen		148.00583	-43.23361	2023
Mosses – Bryophytes						
Leucobryaceae	*Campylopus introflexus?*	heath-star moss		148.00532	-43.23989	2023
Pottiaceae	*Weissia controversa* (HO)	green tufted stubble-moss		148.00518	-43.23943	2023

Reviews

Field Guide to the Seashores of South-Eastern Australia

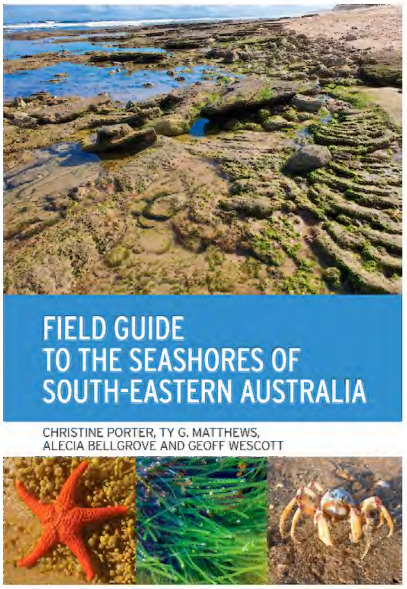
By Christine Porter, Ty G. Matthews, Alecia Bellgrove and Geoff Wescott

CSIRO Publishing, Melbourne, 2023

Softcover or ebook, full colour illustrations, 211 pages

$39.99

Reviewed by Lynne Maher



When volunteers to review books were sought, it was easy for me to put my hand up to undertake that task for this book; I am an amateur when it comes to seashores but I have loved them since I was a child. At the age of about six, I found a seahorse in a small pool near what I remember as the decrepit remains of a jetty at Jaywick Sands in the UK – a find that dismissed my mother's notion that such creatures were mythical.

The authors of this book come with some reputable qualifications which, along with the attractive cover, do invite further reading.

The 'Start here' section includes a simple key, which perhaps is a little overly simple and offers some distinctions that might not be obvious to the beginner. Yes, limpets and chitons move around but to the amateur observer they would appear fixed in place. Similarly, while nudibranchs are related to slugs, your average amateur would maybe struggle to relate some of the more stunning nudibranchs to the molluscs responsible for the damage in their vegetable garden.

Introduction

The introductory chapter touches on some important topics, including human impact on seashores from climate change, pollution, and trampling. It would have been good to see mention of the impact of fish farming in the section on pollution, even if just a sentence in passing. A section on conservation and management is another important inclusion in the introduction and good to see. A short section about food webs includes a delightfully grizzly description of the dining habits of some of our intertidal species, although it did stretch my imagination in likening polychaete worms to vultures, based on the fact that both are scavengers.

Unfortunately, the introductory chapter introduces some terminology, without definitions, that might challenge

those new to marine biology – who presumably are the target audience for that chapter, at least.

Once the book moves into the next sections, terms that are defined in the glossary are printed in bold text the first time they are used – which will be helpful to the reader new to the topic.

Plants

A reasonably comprehensive section on marine plants covers the algae and seagrasses with informative descriptions, a little more detailed than some other publications of a similar nature. It is good to see that, with a few limited exceptions (mangroves and a couple of invasive species) that the range of all species includes Tasmania. In some cases, the small in-situ photographs are less than perfect aids to identification.

I was surprised, and not displeased, to find the addition of saltmarsh plants to this section. While I had not really thought of saltmarshes as seashores, they do undergo some tidal action and most certainly occupy a very important place in our ecology.

Animals of rocky shores

A brief outline of types of rocky shores is accompanied by illustrations, some of which are a bit too small to really appreciate the detail they are trying to illustrate. The illustrations of individual animals are generally good, with descriptions of appearance, as well as habitat and ecology being more detailed than some publications along similar lines.

The book takes us through the expected range of 'lower' phyla, with some interesting snippets of learning (for me, at least) about polychaetes, and does include some of the lesser-known worm phyla.

Phylum Mollusca

The challenge of covering such a large group is evident and some of the generic information about taxonomic groupings may not be helpful to the Tasmanian reader. Starting with the chitons, the examples of ischnochitons do not give the range, and a quick cross reference with Simon Grove's *Seashells of Tasmania* (2011) reveals that most of the examples do not appear to be found in Tasmania.

Subsequent groupings do include the range of the illustrated sample species, which is more helpful for local readers.

The cone shell description does include a 'do not handle' warning, but this maybe could have been emphasised a little more, as is appropriately done for the blue-ringed octopus.

The nudibranchs are barely touched upon in terms of variety, but there is an interesting snippet about the sex life of *Ceratosoma brevicaudatum.*

Phylum Arthropoda

A good coverage of the barnacles progresses quickly through the isopods to a wide variety of crabs, disappointingly omitting the species of hermit crab found in Tasmania. Once again, we are reminded of the risks of using common names as *Notomithrax ursus* is labelled as the bear seaweed crab or hairy seaweed crab, but which is referred to in *Between Tasmanian Tidelines*

(2022) as the decorator crab.

Phylum Bryozoa

This phylum is illustrated by a description of only one species of these beautiful 'lace corals', although I will acknowledge that the many species found in our waters are sublittoral.

Phylum Echinodermata

I was quite surprised to find only two species of sea urchin described, with no reference to the barren-forming *Centrostephanus rodgersii* nor the delightful heart urchins.

Sea stars are much better covered, including the dining habits of *Parvulastra exigua*. Interestingly enough, the reference to the Tasmanian live-bearing sea star *Parvulastra vivipara* suggests the latter is only found in South Australia, yet *Between Tasmanian Tidelines* tells us this is only found in south-east Tasmania, with a related species found in South Australia (which Karen Gowlett-Holmes identifies as *Parvulastra parvivipara*). A single species of brittle star is described, along with a single species of sea cucumber.

Phylum Chordata

This section introduces three of the tunicates, but does not touch on any of the fish species that may be found in the rockpools.

Animals of sandy and muddy shores

This section starts with an outline of the different types of soft-sediment habitats before moving on to the plants and animals that inhabit them. The description of the difference between isopods and amphipods is clearer than the initial description of isopods in the rocky shores section, but the generic illustration of an amphipod does not do much to enhance the reader's understanding.

Examples of the lower phyla which inhabit soft sediments are included, with species of molluscs and crustaceans described in more detail. I found the description of worms ready to shed their gametes as being 'ripe' a little unusual.

A short but useful section describes some of the egg masses commonly found on either rocky or sediment habitats. Similarly, a section on natural marine debris identifies some of the beach-washed specimens that we might find – it includes sea dragons but not sea horses.

This is a book I would not be ashamed to add to my bookshelf as most of the organisms described are found in Tasmania, though at the recommended retail price of $39.96, I would hesitate to take it to the beach and rockpools with the kids. For that, I would return to the more economically priced *Between Tasmanian Tidelines* (2022), returning home to look up a little more information in this book, in Simon Grove's *The Seashells of Tasmania* (2011), Karen Gowlett-Holmes's *A Field Guide to the Marine Invertebrates of South Australia* (2008) and Graham Edgar's *Australian Marine Life* (1997, 2000), along with that perennial favourite, W. J. Dakin's *Australian Seashores* (1980), subsequently adapted and updated by Isabel Bennett (1987).

Tasmanian Mayflies: Identification, Ecology, Behaviour and Imitation

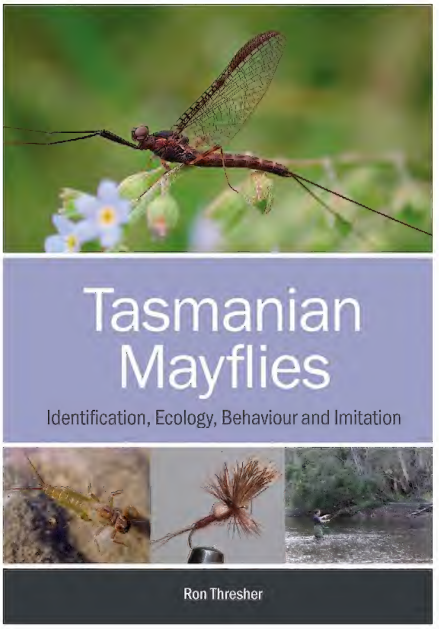
By Ron Thresher

CSIRO Publishing, 2023

Softcover or ebook, 219 pages

$59.99

Reviewed by Keith Martin-Smith



Mayflies, although perhaps not the most familiar insects to everyone, have a strong influence in our cultural life. The name of their order, Ephemeroptera, comes from the same root as our word 'ephemeral', alluding to the brief lives of the adults, noted by naturalists since the time of Aristotle and Pliny the Elder and referenced in the Epic of Gilgamesh. In fly fishing they are the primary models for artificial flies and thus a source of intense study and exasperation by anglers – Izaak Walton describes using them in *The Compleat Angler* in 1653. It is through the latter route that Ron Thresher, a prominent marine scientist, first became interested in Tasmanian mayflies – an interest that he has developed over 30 years into this new comprehensive guide.

The book starts with a brief section on the biology of mayflies – tantalising us with snippets such as a recorded emergence of mayflies in the USA of more than 87 billion individuals or some mayflies living for less than an hour as adults! In order to keep the book readable, Ron does not provide in-text references, but there is a detailed Further Reading section at the end which should keep even the obsessive mayfly enthusiast happy.

The greater part of the book is an identification guide to the approximately 55 currently recognised species of mayfly in Tasmania. Starting with a short chapter on morphology, there are keys to the five families of mayfly in Tasmania for both aquatic nymphs and terrestrial sub-adults/adults. Two additional mainland families are included in the keys and briefly described in the text. Within each family every genus is treated separately with keys to the species where necessary. Each species has a full description, photographs of adults, nymphs and relevant body parts necessary for identification (e.g. genitalia, labrum or tarsal claws), a distribution map, behaviour and ecology notes, and relevance to fishers. This represents the results of painstaking and detailed

endeavour over many years of research.

There is a rather depressing chapter on the conservation status of mayflies in Tasmania, with considerable evidence for declines in many species due to the usual suspects of habitat modification, pollution, climate change and invasive species (ironically including the brown trout which first prompted Ron to study mayflies!). Three species are proposed for consideration as endangered species.

The final chapters are aimed squarely at the fishing community with descriptions of mayfly hatches and artificial flies that might help an angler land a trout at different times or places …

Consistent with Ron's fly-fishing interest is the frequent use of common names in the text for particular species. However, since not all species have common names, others are referred to solely by their scientific binomials and, indeed, sometimes the scientific name is also used for those with common names. I found this a bit confusing and I would have preferred that scientific names were used consistently through the text.

Overall, this a great resource, synthesising a large amount of research in addition to Ron's considerable personal contribution. It is a fascinating and very readable account of this important order of insects. I suspect it will appeal to the scientifically minded angler as well as the entomologist and will be a standard reference for a long time.

Seasons in the South: A Tasmanian Naturalist's Journey of Discovery – and Recovery

By Simon Grove

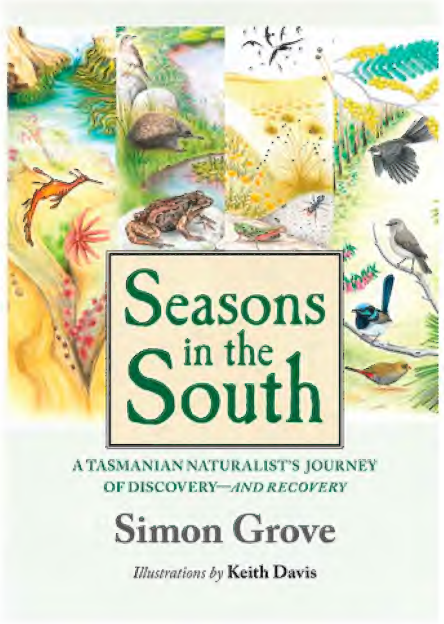
Illustrations by Keith Davis

FortySouth Publishing, 2023

Softcover, 416 pages

$59.95

Reviewed by Eddie Gall
eddiegall@bigpond.com


Seasons in the South
A TASMANIAN NATURALIST'S JOURNEY OF DISCOVERY—AND RECOVERY
Simon Grove
Illustrations by Keith Davis

Simon Grove is a frequent contributor of authoritative articles to *The Tasmanian Naturalist*. He is a winner of the Australian Natural History Medallion and has authored *The Seashells of Tasmania: A Comprehensive Guide* and co-authored *Beetles: An Illustrated Checklist of the Insects of Tasmania. Part 1 – Coleoptera.*

Seasons of the South is subtitled 'A Tasmanian Naturalist's Journey of Discovery – and Recovery' and is his first book in a narrative style. The text is complemented by a marvellous set of 13 colour and 81 line drawings by Keith Davis.

This book relates Simon's encounters with Tasmania's nature over his 20 years in Tasmania. It includes little-known and absorbing snippets from the history of Tasmanian entomology and malacology. Its scope goes well beyond seashells and beetles, taking in, amongst other things, geology, grasstrees, bitterns and cephalopods; and is stitched together with the history of the palawa people and colonial settlement.

Each chapter of this month-by-month tour of the natural world features sections of particular seasonal interest (and a butterfly of the month). To improve readability, Simon steers clear from scientific nomenclature, though, where pertinent, he does give insights into some of the interesting peculiarities of the historic origins as well as the strange origin of some common names.

The book is sprinkled with pearls of wisdom, such as Grove's Law of gastropod reversibility. Of particular interest are insights into Tasmanian lifeforms and ecological interactions which, even for most naturalists, go under the radar: for example, the kleptoparasitic habits of miltogrammine flies, and what he terms "deadwoodology".

He uses a mixture of personal experience, coupled with the sharp observation of a scientist's eyes (and ears, and nose!). He relates his experiences at work, and his weekend and holiday enjoyment. There are insights into the conduct of scientific field trips and long-term study sites. His passion for his interests shines.

He uses an enjoyable and relaxed style that is easy to read. There are many good stories and musings, craftfully written and beautifully stitched together so they make a woven continuum. Unlike many other books of this type, there is a strong narrative. The very personal underlying theme of the book is about Simon's long and arduous journey surviving two bouts of leukaemia and their physical, mental and long-term impacts. He paraphrases Confucius: "We are born with two lives, and the second one starts when we realise that we only have one." His close encounter with death has focused his priorities. His previously referred-to book on Tasmanian seashells was written as a project to help him cope with his illnesses. It also seems to have contributed to the inception of this book.

He owes much to the restorative powers of nature and believes that we evolved as part of, and are immersed in, the natural world; we derive meaning from contact with animals, plants and the broader natural world. He concludes with a well-written plea for humanity, as a group and as individuals, to go beyond the utilitarian view of nature.

With its wide scope and authoritative content, this book will have wide appeal to naturalists of all persuasions. Whether you might want a book for a rainy day, something to take travelling, or something to expand your understanding

of Tasmania's nature, Simon's book will fit the bill.

Simon's book is available for purchase from bookshops around Tasmania, directly from FortySouth, or can be ordered online at https://www.southernseasons.com.au .

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Where the Slime Mould Creeps

By Sarah Lloyd OAM

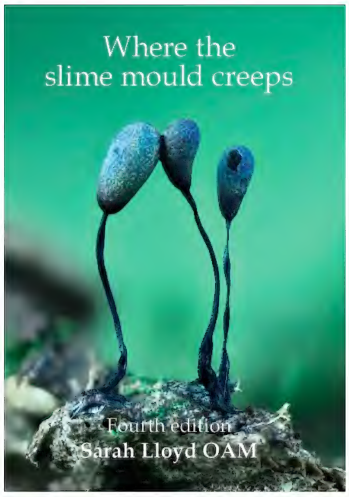
Fourth edition

Tympanocryptis Press, 2022

Softcover, 124 pages

$45

Reviewed by Sabine Borgis



The first edition of *Where the Slime Mould Creeps* was published in 2014, and this is its fourth edition. Perhaps that is a reflection of the growing interest in the myxomycetes, a group of organisms whose classification has eluded taxonomists for a long time. Lloyd's meticulous observations and documentation of the slime moulds on her property at Birralee in the central north of Tasmania have contributed enormously to this growing interest among naturalists in Tasmania, as well as the few specialists in Australia and worldwide.

The fourth edition, which maintains the same format, contains photographs of over 60 species – about half of the number found on the property, and almost one-fifth of the ca. 330 species so far described in Australia. It includes several time-lapse series of the visible stages of development. It describes the different stages of the myxomycete life cycle, from spores to myxamoebae or swarm cells, to zygotes, plasmodia and fruiting bodies, with a detailed section on the fruiting body parts. A surprising fact mentioned in the Distribution section is that myxomycetes occur even in more arid habitats, but that species diversity is lower in tropical habitats. The section on research has been expanded to include how slime moulds' networks have inspired design principles, and their bioactive compounds. This edition still includes chapters on how to collect, identify, store and photograph slime moulds; the relationship (or not) between fungi and myxomycetes, and their known evolutionary origins; and, on a creative note, the score to two little tunes inspired by slime moulds.

Part 2 contains habitat descriptions of Black Sugarloaf; the chapter 'Common, rare or new to science?', which describes Lloyd's research journey at

Birralee, including finding new species and investigating phenomena such as iridescence. This part also expands on some of the interactions with invertebrates, many of which feed on slime moulds. A larger section is devoted to 'Slime mould hotspots', particular substrates found to be favoured by slime moulds at Birralee.

Part 3 comprises an alphabetically arranged gallery of species, some with time lapse series (added to in the Appendix). I find the chapter on classification somewhat confusing for amateurs as it appears to be reverting to an older, 'traditional' model of classification, perhaps pending clearer outcomes of continuing DNA sequencing studies. The checklist of Australian myxomycetes has been updated from Steven Stephenson's *Secretive Slime Moulds: Myxomycetes of Australia* (2021, CSIRO Publishing), with an index of species covered in this book.

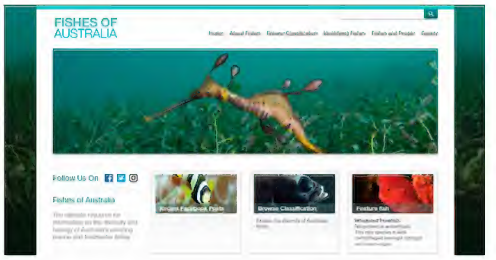
Where the Slime Mould Creeps was obviously never intended to be a comprehensive field guide; those who wish to delve deeper into this field should go to Sarah Lloyd's other volume, *Myxomycetes at Black Sugarloaf, Tasmania, Australia* (2020), or invest in Stephenson's abovementioned book. Rather, its main function is to arouse people's interest in and inspire them to look for these ephemeral, shape-shifting organisms, while imparting a basic – and growing – understanding of what makes them tick.

Website:

Fishes of Australia

https://fishesofaustralia.net.au

Reviewed by Sabine Borgis



In last year's Tasmanian Naturalist, Bob Mesibov compiled a quite comprehensive review of websites for Tasmanian naturalists. Nevertheless, there is always room for another. While I am neither a fisher nor a diver, and a couple of boat trips, sadly, resulted in seasickness, I find fish fascinating, with their staggering diversity of forms, sizes and habits. Some have quirky and intriguing names, such as pencil smelt, squirrelfish, loosejaw, flutemouth and redvelvet whalefish. I discovered this website when I wanted to know what a fish species mentioned by one of our regular contributors looks like. Although it covers fishes of all Australian waters, it is a useful resource for Tasmanian naturalists as more fish species previously not found in our waters are making their way further south thanks to climate change.

It is easy to spend hours exploring this site – without even getting your feet wet. On its home page, the website is introduced as:

> The ultimate resource for information on the diversity and biology of Australia's amazing marine and freshwater fishes.

The main menu contains the sections About Fishes – a general introduction, Fish Classification, Identifying Fishes, Fishes and People, and a Gallery.

Fish Classification has a menu of summary descriptions of each Class, and a tab to References. Each Class contains further dropdown menus of the Orders, Families, Genera and Species within it.

The Identifying Fishes page states:

> Fishes can be hard to identify. They range in size from tiny gobies less than a centimetre in length to the enormous whale shark. Not only do they come in [a] wide variety of shapes and colours, males and females often differ, and juveniles may appear very different from adults of the same species.

The simple, clear line drawings make this an easier task, complemented by photographs in an image gallery, and each species is accompanied by a distribution map. There is also a Quick Facts box containing the CAAB (Codes for Australian Aquatic Biota), depth at which the species is found, its habitat, its maximum size, conservation status, and whether it is native or introduced. This page has further links to a Key to Australian Fish Families and a Freshwater Fishes Key.

Fishes and People gives a summary of fish conservation issues; fishing (with links to government departments that issue permits and manage commercial fisheries); and dangerous fishes (aggressive, shocking, venomous and poisonous).

Right at the bottom of the home page, the Resources tab takes you to an extensive list of fish-related resources such as a database of archaeological fish-bone images, Australian Standard Fish Names and a shark attack file. There is also a list of books published since 1970.

The website is hosted by Museums Victoria on behalf of the OzFishNet community, and the Partners tab reveals that ichthyologists from several museums and other institutions including CSIRO and the Australian Biological Resources Study have been involved in compiling this resource. The website's editors are Dianne Bray, author of the 2008 book *Fishes of Australia's Southern Coast*, member of the Australian Society for Fish Biology and a regional representative of Redmap, and Martin Gomon, Senior Curator, Ichthyology, at Museums Victoria. It is published under Creative Commons licences.

Sponsorship

The Tasmanian Naturalist is published annually, with printing and distribution costs sourced directly from membership fees. With ever-increasing costs to production and the Club's recent shift to a higher quality presentation of the journal, which includes perfect binding, better quality paper and full colour, the Club now looks for support to offset the higher costs of production each year.

As well as the printed version of *The Tasmanian Naturalist*, electronic copies of every edition since inception are available on our website at:

https://tasfieldnats.org.au/naturalist/

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Advice to contributors

The Tasmanian Naturalist publishes articles on all aspects of natural history and the conservation, management and sustainable use of natural resources, with a focus on Tasmania and Tasmanian naturalists. These can be either in a formal or informal style. Articles need not be written in a traditional scientific format unless appropriate for the content. A wide range of types of articles is accepted. For instance, the journal will publish articles that:

- summarise or review relevant scientific studies, in language that can be appreciated by field naturalists;
- stimulate interest in, or facilitate in identifying, studying or recording particular taxa or habitats;
- record interesting observations of behaviour, phenology, natural variation or biogeography;
- stimulate thinking and discussion on points of interest or contention to naturalists;
- put the study of natural history today into context through comparisons with past writings, archives, etc.; or
- review recent publications that are relevant to the study of Tasmanian natural history.

Book reviews, website reviews, poetry and prose, and other informal natural-history related content are also accepted. If you are thinking of submitting such material, please check with the Editor first, to avoid duplication of items such as book reviews and for appropriateness of content.

Submission of manuscripts

Manuscripts should be emailed to the editor at editor@tasfieldnats.org.au or to the Club's address. Contact the Editor prior to submission if you have any issues to discuss. Formal articles should follow the style of similar articles in recent issues and include an abstract. Informal articles need not fit any particular format and need not have an abstract. Unless otherwise stated, all images are by the author(s). All articles will be reviewed by the editors and/or external referees. Responsibility for accuracy and currency of taxonomic nomenclature rests with the author(s). The editors use the *Macquarie Dictionary* and *The Style Manual for Authors, Editors and Printers* as standard reference texts. It is important to refer to the Guidelines for Authors, available on the Club's website at www.tasfieldnats.org.au/naturalist/.

Submissions should be provided electronically in standard text files. Images, tables and diagrams should be submitted in separate files. They must be of high resolution and suitable to be published at A5 size.

Articles must be submitted by 31 August to meet publication schedules.